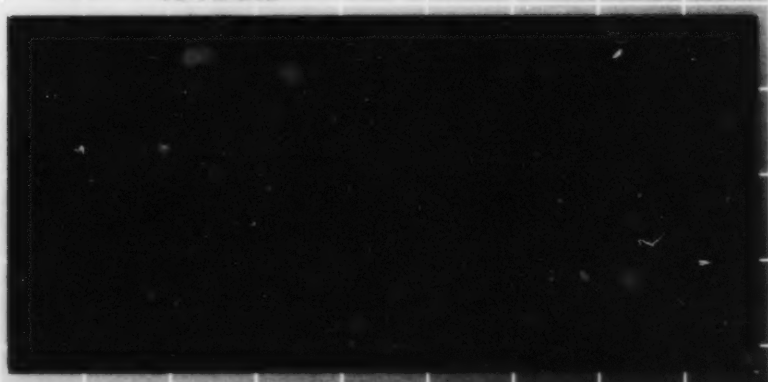
Economic Council
of Canada

Conseil économique
du Canada



Working Paper
Document de travail

Working Paper No. 23

Goods and Service Sectors Structural Change and Canadian Economic Growth, 1967-86

D.C.A. Curtis and K.S.R. Murthy

1991

ISSN 1180–3487

Goods and Service Sectors Structural Change and Canadian Economic Growth, 1967-86

A Three-Sector Model of Goods and Service Sectors Dynamics in the Canadian Economy

The findings of this paper are the sole responsibility of the authors and, as such, have not been endorsed by the Economic Council of Canada.

The Economic Council's Working Papers are protected by the Crown copyright and may be reasonably quoted under the terms of Canada's copyright laws. Requests for permission to reproduce or quote long excerpts should be addressed to:

Director of Publications
Economic Council of Canada
P. O. Box 527
Ottawa, Ontario
K1P 5V6

92-05356/

Contents

Acknowledgments vii

Foreword ix

Abstract xi

Introduction 1

Growth and Structural Change in Canada, 1967-86 1

Theoretical Background 6
The Maturity Thesis 6
Unbalanced Growth Models 7
Industrial Organization Arguments 8

Model Structure and Intersectoral Linkages 9
Aggregate Supply – Sectoral Disaggregation 10
Aggregate Demand – Expenditure on Final Goods and Services 13

Model Structure, Parameters, and Structural Change 15

The Structural Dynamics of Sector-Specific Demand and Supply Shocks 19
Demand Increases by Sector 20
Tax-Induced Demand Decreases 23
Productivity Increases by Sector 29

Conclusions 33

A Definition of Variables 37

B Estimated Equations 41

List of Tables and Chart 53

Bibliography 55

Acknowledgments

We gratefully acknowledge financial assistance from the Economic Council of Canada and Trent University for a part of the project on which this paper is based. Tom Siedule also helped with problems associated with National Accounts revisions and data collection. Comments by Gordon Betcherman, Norman Leckie, Tom Siedule and Ron Bodkin on earlier drafts improved the presentation. Christianne Dini provided invaluable research assistance in data collection and estimation of the model.

Foreword

Economists are now devoting more and more attention to the rapid expansion of services and the growing economic importance of that sector. One of the important questions in this area concerns the nature of the linkages between services and the goods sector.

In addressing that question, the Economic Council commissioned the study undertaken by Professors Curtis and Murthy which is presented in this monograph. This research has made a major contribution to our understanding of the relationship between the sectors. Using an econometric model which disaggregates the economy into the goods, commercial services, and non-commercial service sectors, the authors were able to focus in unique ways on the interactions between the different sectors. By undertaking various simulations, they have identified fundamentally different roles for goods and services. Their research demonstrates the interdependencies of the sectors and, in particular, the important role of the goods industries in stimulating demand for services and, indeed, the aggregate economy.

This study was undertaken as part of the Economic Council project on employment and the service economy. From this analysis, we released *Good Jobs, Bad Jobs*, a Council Statement [1990], and a research report, *Employment in the Service Economy* [1991]. Professors Curtis and Murthy are with the Department of Economics at Trent University in Peterborough.

Judith Maxwell
Chairman

Abstract

There is a great deal of interest, at present, in structural change in industrial economies; notably the expansion of the service-producing sector in terms of output and, more importantly, in terms of employment, relative to other sectors. In this exercise, we look at the experience of the Canadian economy and attempt to explain some of the structural change, during the period 1967-86, by the use of a small macroeconometric model. This model is disaggregated into three sectors: goods, commercial services, and noncommercial services; and on this basis, and in terms of sectoral variables within limits dictated by the availability of sector-specific data in National Income Statistics, it provides a test for analysing the short-run dynamics underlying the long-term structural change.

The results of simulation experiments conducted on the model, affecting separately the goods and service sectors, reveal interesting insights into the dynamics of interactions among these sectors. The results indicate significant differences in the impacts of equal demand- or supply-side disturbances impacting separately on goods-producing and commercial-service-producing sectors. The process of structural change in both short-term and long-term time horizons and the performance of the aggregate economy are affected. The importance of these results lie, in large part, in the control policymakers may have over the type of sector of initial impact of either demand- or supply-side changes.

Introduction

Earlier work on structural change has established the long-run empirical relationship between economic growth and structural change. Some of this work emphasizes the structural evolution of demand as economies move to higher levels of real per capita income, concentrating on the demand side of the relationship. Other studies, following Baumol [1967], focused on the supply side, particularly the distribution of employment among sectors and sectoral differentials in productivity growth rates within the process of aggregate economic growth. Both demand and supply aspects were combined in a long-run general equilibrium framework by Fuchs [1968] and more recently by Inman [1985]. The most recent work, for example Barber [1988], Barras [1986], Gershuny and Miles [1983], and Grubel and Walker [1988], has raised the possibility that structural change itself contributes to economic growth rather than being simply driven by it, as earlier work suggests. From another perspective, however, the rise of the service sector, or "deindustrialization," has given rise to concern about the prospects for continued economic growth and prosperity. While all these topics cannot be discussed in detail here, the overall framework we present provides an important integration of these dimensions of the process. This involves the use of a small macroeconometric model.

The policy aspects of the short-run dynamics of structural change and sectoral linkages are significant. Government expenditure and tax policy may impact differently on sectoral demand components to produce different structural and performance effects. Policy initiatives in other areas impact differently on sector-specific supply conditions through competitive pressures and regulatory constraints. We explore the basic implications of these policy issues in our simulation experiments.

As a background to the analysis of structure and structural change, the next section presents the basic empirical pattern of recent Canadian experience. The following section surveys previous work and theoretical approaches. The section entitled "Model Structure and Intersectoral Linkages" describes briefly the main structural relationships of our model. "Model Structure, Parameters, and Structural Change" considers the insights into the process of structural change provided by the estimates of model parameters. Four sets of simulation experiments are presented in "The Structural Dynamics of Sector-Specific Demand and Supply Shocks" to illustrate demand and supply aspects of structural change and economic performance. The final section offers some concluding comments.

Growth and Structural Change in Canada, 1967-86

Canadian experience over the 1967-86 period illustrates many of the questions raised about the relationships between growth and structural change. It

also provides the empirical background for our model construction and subsequent simulation experiments. Table 1 presents some basic observations.

Definitions of sectors of the economy, structure, and structural change are essential to an interpretation of these data. Three sectors are defined based on the Standard Industrial Classification used by Statistics Canada: a goods-producing sector made up of primary, manufacturing, and construction industries; a commercial-service-producing sector made up of trade, transportation, communication, utilities, recreation, hospitality, finance, insurance, and real estate industries; and a noncommercial service sector that includes health, education, welfare, and public administration. Output and employment data are classified by sector on these definitions.

The limitations of data availability require a different basis for defining expenditure by sector. In this case the GDP expenditure approach identifies final expenditure on goods and on services in the household sector and in international trade. Accordingly, final expenditure on goods is defined as the sum of consumption expenditure on goods, capital expenditures, both private and government, and exports of goods minus imports of goods. Final expenditure on services is the sum of consumption expenditure on services, government current expenditure, and exports minus imports. Although we do not disaggregate in this way, government current expenditure may also be considered as final expenditure on noncommercial services.

Economic structure and structural change have been considered in different ways in different studies. We use three measures common to other approaches, namely the distribution of:

1 final expenditure between goods and services;

2 employment among goods, commercial services, and noncommercial service industries;

3 output among goods, commercial service, and noncommercial service industries.

We have measured economic growth in terms of annual average percentage change in real per capita GDP and in real aggregate GDP. Table 1 reports observations on structure and growth in these terms.

Observations for the entire 1967-86 period illustrate the relationships emphasized by long-term studies of structural change, with one key exception. The 20-year pattern of growth, the structural shift in output towards commercial services, the corresponding shift in employment, and the patterns of productivity growth rate differentials all accord with the explanations offered

by Baumol [1967], Fuchs [1968], and subsequent work in that context. The exception is the remarkable stability in the structure of final expenditure (in Part A of Table 1). The coincidence of such final demand stability with large shifts in the distribution of employment and output suggests that intersectoral specialization at intermediate production levels is a fundamental aspect of the process of growth and structural change.

In contrast to the 1967-86 observations, the subperiods illustrate some different and interesting aspects of short-run changes in economic structure. The 1967-74 period, for example, illustrates what Rowthorn and Wells [1987] define as "positive deindustrialization": high rates of output and productivity growth coincident with a strong shift in economic activity towards service-producing industries. This was also a time in which final expenditure shifted towards goods.

Observations on the 1974-81 period illustrate the opposite situation. Economic growth was substantially slower than in other periods and productivity growth all but disappeared from the goods-producing industries. Sectoral productivity growth rate differentials were the reverse of those observed over the entire period, and those reported in other studies. Service-sector expansion in such a period of relative stagnation has been defined by Rowthorn and Wells [1987] as "negative deindustrialization," although the strong productivity growth in the commercial service sector is unusual by their standards.

The final subperiod reported in Table 1 covers a time of deep recession and strong recovery. In the recovery phase in particular, productivity growth was very strong and reestablished the expected differentials among sectors in productivity growth rates. The shift in structure, as measured by changes in the sectoral distribution of employment, reflects these productivity growth rate differentials. Otherwise, the recession-recovery experience appears as a time of balanced growth in terms of the composition of both expenditure and output.

These empirical observations raise questions about the process of structural change and its relationship to economic growth. There are questions about the evolution of demand structure over long periods, about its short-run cyclical behaviour, and about the determinants of the distribution of expenditure between sectors. The structure of production, the potential to restructure production, and the effects of such changes on productivity and employment also raise important questions for analysis. The analysis of these issues essentially involves an examination of the short-run dynamic relationships underlying the longer run shift in aggregate economic structure. To deal with them simultaneously and consistently requires a formal model structure.

Table 1

Structure, Structural Change, and Growth in the Canadian Economy, 1967-86

	1967	1974	1981	1986
		(Per cent GDP in 1981 dollars)		
A Structure of final expenditure				
On goods	57	59	58	58
On services	43	41	42	42
Total	100	100	100	100
		(Per cent by industry)		
B Industrial distribution of employment, output, and capital				
Employment				
Goods industries	40.8	35.8	32.5	29.4
Commercial service industries	40.1	43.2	46.5	48.9
Noncommercial service industries	19.1	21.0	20.9	21.7
All industries	100.0	100.0	100.0	100.0
Output (GDP in 1981 dollars)				
Goods industries	45.2	42.2	36.9	36.5
Commercial service industries	35.0	38.3	45.1	46.1
Noncommercial service industries	19.7	19.6	18.1	17.4
All industries	100.0	100.0	100.0	100.0
Capital stock (1981 dollars)				
Goods industries	31.5	30.6	30.9	29.7
Commercial service industries	38.3	41.2	45.9	49.5
Noncommercial service industries	30.2	28.2	23.1	20.8
All industries	100.0	100.0	100.0	100.0

Table 1 (cont'd.)

	1967-86	1967-74	1974-81	1981-86
	(Average annual per cent change in real GDP per employee)			
C Labour productivity growth by sector				
Goods industries	2.4	3.2	0.1	4.6
Commercial service industries	2.1	2.4	2.0	1.0
Noncommercial service industries	0.0	0.6	–0.5	0.0
All industries	1.6	2.0	0.9	1.6
	(Average annual per cent change)			
D Growth in real per capita and aggregate GDP				
Per capita GDP	1.8	2.8	1.2	1.4
Aggregate GDP	4.3	5.9	3.7	2.9

Source Based on data from Statistics Canada. Expenditures are at market price, and outputs at factor costs.

Theoretical Background

Previous work on the relationships between economic structure and aggregate economic performance has followed a few major approaches and subsequent refinements to these approaches. The following discussion summarizes this work with two objectives in mind. First, the theoretical work provides some perspectives on the empirical observations presented in the previous section. Second, and more importantly, previous work provides the theoretical background that guides the specification of relationships within our framework of a multisectoral dynamic model.

The Maturity Thesis

This approach has a long history in the literature, dating back at least to Clark [1940] and earlier writers. The argument in essence is that structural change, defined as shifts in output and employment from goods industries to service industries, is just a normal part of the process of economic growth and progress. For the most part, the argument has been used to explain differences in economic structure between or among countries, and shifts in those differences in time. The causes of the shift, however, are not explained explicitly.

A recent example of this "maturity thesis" approach to the explanation of structural change is provided by Rowthorn and Wells [1987]. They specify the following equation:

$$e_m = a + b \log Y + c(\log Y)^2 + dU + eB_m \qquad (1)$$

where e_m is the share of manufacturing employment in total employment, Y is real GDP per capita, U is the unemployment rate, B_m is net manufactured exports as a share of GDP averaged over a five-year period, and a, b, c, d, and e are parameters of the relationship. A similar equation is used by Van Gemert [1987] to explain shares of output rather than shares of employment. In both cases the equations are estimated on a cross-sectional basis for a sample of OECD countries to test explanations of observed differences in structure across countries in the sample. In the Rowthorn-Wells specification presented here, the hypothesis being tested is that different phases of the business cycle, as indicated by U, and different degrees of national specialization, as measured by B_m, explain differences in economic structure not accounted for by different levels of maturity.

This approach to explaining structure is widely used in international comparisons and national studies. Examples in different contexts are provided by Kravis, *et al.* [1983], Gemmell [1982], Leveson [1985], and Gershuny and

Miles [1983]. In essence it suggests some undefined process, perhaps the "unbalanced growth" model discussed below, linking structure to per capita income, and then seeks further explanations of variations in structure among countries and over time. Cyclical factors, international trade and national specialization, population growth, and significant innovations such as microelectronics are the explanatory variables added in this process. Most of these factors are included in the framework of our model.

Unbalanced Growth Models

The Baumol-Fuchs "unbalanced growth" type model, based on Baumol [1967] and Fuchs [1968], considers the causes of structural change in a long-run general equilibrium context. It may be thought of as an explanation of the growth-structural change relationship in the maturity thesis. As recently elaborated by Inman [1985], the model yields the following equilibrium condition:

$$e_s = (a-1)\,r_m + D + (r_m - r_s)(1+B),\ a>0,\ B<0. \qquad (2)$$

In this equation, e_s is the service sector's share of aggregate employment, r_m and r_s are the rates of growth of labour productivity in manufacturing and services, B is the price elasticity of demand for services, and D is an exogenous shift factor in the demand for services. Studies adopting this approach, either explicitly or implicitly, use estimates of the elasticities and productivity growth to establish the relative importance of these factors as causes of the shift in employment. Any residual growth in employment share is accounted for by the exogenous shift in demand.

Results of this approach as reported by Inman [1985] using Fuchs' [1968] estimates for elasticities and productivity growth for the U.S. economy for 1929-65 indicate that differential productivity growth rates were the major source of the observed shift in employment to the service sector. Similar results in a Canadian context have been provided by Worton [1969], Magun [1982], and Picot [1986], although none uses the Inman equation explicitly, concentrating instead on productivity growth rate differentials and elasticities in less formal frameworks. The studies reported in the volume edited by Inman [1985] provide a broader range of national and international applications and some critical assessments.

Indeed the continuing relevance of the "unbalanced growth" model as an explanation of secular shifts in employment structure is worth mentioning. At least two papers, Barras [1986] and Leveson [1985], question the likely persistence of productivity growth rate differentials of the magnitude observed by, say, Fuchs [1968], into the near future. Earlier observations on patterns

of labour productivity growth by sector in Canada presented in Table 1 raise the same question. Will technological change eliminate these differentials that are seen as the prime cause of the long-term shift in structure? Baumol, *et al.* [1985] think not, although they may produce short periods of structural stability, or temporary departures from the trend of structural change, during short bursts of productivity growth in services following major innovations.

Two aspects of this approach to the explanation of structural change are important to the specification of our model. First, potential causes of structural change, as measured by changes in employment shares, are identified. Second, these causes are presented and examined in the broadest terms of comparative static analysis. Each of these aspects must be considered in our model specification and estimation.

The causes identified are: 1) different price elasticities of demand by sector; 2) different income elasticities of demand by sector; 3) exogenous intersectoral shifts in demand; and 4) different labour productivity growth rates by sector. In other words, three possible demand explanations and one possible supply-side explanation operating simultaneously. Estimation of equations on the demand side of the model provides opportunities to test a wide range of possible differences in demand by sector. In this process, the modelling will depart as well from the static long-run aspects of the explanation of expenditure to consider the short-run dynamics and the interactions between sectors, both aspects ignored by the long-run equilibrium approach.

The supply-side causes of long-run structural shift present a more complex set of questions for model specification. In the long run, the identified causal factor is differential productivity growth. But where does the differential come from? Is it from different rates of capital accumulation by sector, from technological change, from different sectoral labour market and wage rate effects, from the substitution of inputs of one sector for direct production in another sector, or a combination of all the above and other factors? In the "unbalanced growth" model, productivity growth differentials are the most important causes of structural shift but are themselves exogenous. In a dynamic multisectoral simulation model at least some of the reasons for differential productivity growth rates must be explained in the context of the structure, equations, and dynamics of the model. Previous work points the way but does not deal with the specifics of estimation.

Industrial Organization Arguments

A further explanation of structural change, particularly from a short-run perspective, has emerged quite recently in the literature. Gershuny and Miles [1983] argue the significance of technological change as a source of shift in

both demand and supply conditions among sectors. This picks up on the variable included earlier in the "unbalanced growth" equations. But Barber [1988] is more explicit when he argues that reorganization of production, especially the increased substitution of intermediate services for in-house provision in goods-sector production, is an important cause of structural change. While Gershuny and Miles have noted similar possibilities in consumption, data presented in Table 1 suggest that it is in the production process that the implications are more important.

The interaction between sectors implied by the flow of intermediate inputs between sectors, through "contracting out," appears to be a fundamental aspect of aggregate productivity growth. As goods-sector producers shift from in-house to purchased service inputs such as accounting, engineering, marketing, maintenance, security, and transport, for example, value-added and employment shift between sectors. Goods sector value-added declines, service sector value-added increases. Assuming the service sector is more efficient in the production of services than the goods sector, service-sector employment expands by less than the corresponding reduction in goods-sector employment. Goods-sector labour productivity grows through specialization in areas of comparative advantage. Service-sector productivity may grow as well but may lag behind goods-sector productivity growth if opportunity for technological change and reorganization are more restricted. Earlier empirical observations confirm that commercial-service-sector productivity growth may exceed goods-sector productivity growth. Thus, overall, the process of structural change produces growth in aggregate productivity and allocates that growth among sectors.

The foregoing is essentially an argument about interactions between sectors. This is an aspect of structural change and economic growth that is largely ignored by the two main approaches to analyses outlined above. However, it is recognized by Barber [1988] as noted, and further developed and emphasized by Brown [1986] and by Bailly, *et al.* [1987]. Such linkages between sectors on the supply side are central to the short-run dynamics of the process as we model it.

Model Structure and Intersectoral Linkages

The objective is to identify the determinants of structural change, the interactions between sectors, and the dynamics of the process. To this end we assembled a small quarterly macroeconomic simulation model of the Canadian economy, disaggregated into a goods, commercial services, and noncommercial service sectors. This section discusses the basic structure and linkages within that model, in general terms. A more detailed technical report on the

model equations and the estimation results is in preparation and will be available from the authors by request.

The model is unique in terms of its small size and sectoral disaggregation. Its theoretical framework corresponds to that of other Canadian models such as RDXF [Bank of Canada, 1988] or FOCUS [Institute for Policy Analysis, University of Toronto, 1985]. Interdependent sectoral aggregate demand and supply functions are defined, with supply functions incorporating expectations-augmented Phillips curves and the "natural rate" hypothesis. Expectations are formed adaptively in this version of the model, although we continue to experiment with different forms of (weak) rational expectations. The main emphasis of the model is its focus on three output sectors, their contributions to macroeconomic performance, and the evolution of the employment-output structure of the economy.

Aggregate Supply – Sectoral Disaggregation

The main linkages in the model are illustrated in Chart 1. The estimated equations and variable definitions are provided in the appendices.

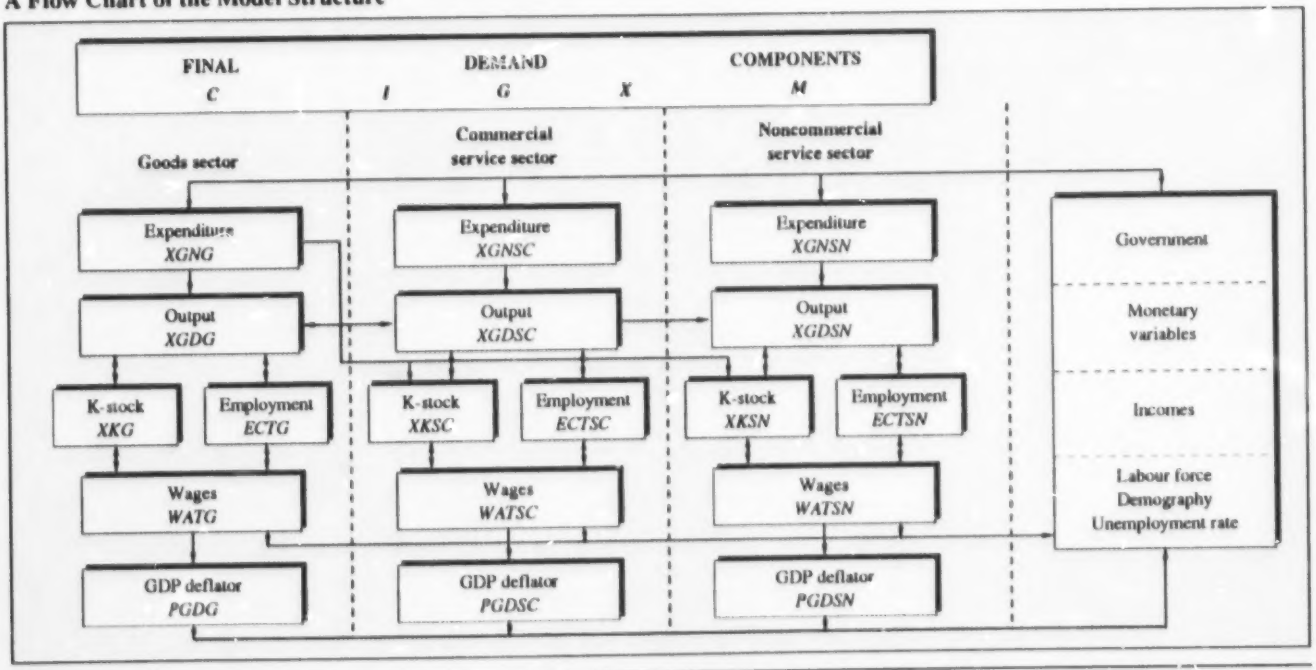
The model has three sectors on the supply side, namely a goods sector, a commercial service sector, and a noncommercial service sector, as defined above. Aggregate real output, *XGDP*, is explained by three sectoral output equations, employment by three employment equations, and prices by three sets of price equations.

The distribution of aggregate output among sectors is explained by three types of demand influences. Expenditure on final output at market price is disaggregated into expenditure on goods and on services, and impacts directly on output by sector. In addition there are complementarities among sectoral outputs and various patterns of bundling of outputs at retail or final sales levels. The equations for goods-sector output and commercial-services output presented in the appendix reflect strong direct demand effects and rather weak complementarity between sectors. The latter involve, for example, the purchase of insurance and service along with new consumer durables, or cable TV services along with new TV sets, or more electricity along with electrical appliances, and so forth. Alternatively the purchase of commercial services such as alpine skiing involves a demand for ski equipment and clothing as well. Thus direct and complementary demand effects combine to explain the outputs of the market sectors of the economy.

Noncommercial-service-sector output is similarly explained by demand, in the form of government current expenditure, and by complementarity between

Chart 1

A Flow Chart of the Model Structure



noncommercial services and market-sector expenditure. An example would be the link between air travel and airport services.

Nevertheless, important intermediate linkages among sectors are not explicitly modelled in the output sectors. Their impacts are captured by the definitions of output. Sector output is net output measured by aggregate value-added for each group of industries. As a result, most restructuring of production, for example contracting out accounting services by goods producers, or basic menu entrées by fast food services or hospitals, appears as a shift in economic activity between sectors that is not explained directly by final demand factors.

However, these are fundamentally important aspects of structural change. As argued by Barber [1988], Barras [1986], and Grubel [1987], they may be seen as responses to the dynamic evolution of sectoral comparative advantage. Goods-sector producers may specialize increasingly in pure goods production by substituting an increasing range of commercially available intermediate services – design, computing, maintenance, security, payroll, capital equipment services by lease, and so forth – for in-house provision. The result of such increased specialization by sector is increased aggregate productivity growth, just as increased real income accrues to nations who specialize according to national comparative advantage. Within the structure of the model, these shifts are important but exogenous determinants of output by sector.

The second major dimension of structure and structural change, namely the sectoral distribution of employment, follows from the sectoral distribution of output. Three sectoral employment equations are used. Chart 1 illustrates their linkage to the output sectors.

The employment equations explain sectoral employment based on cost-minimizing behaviour of producers whose output is demand determined. This approach is different from other studies that explain differences in sectoral employment growth by exogenous productivity growth rate differentials among sectors. We follow Barker and Peterson [1987] and the Cambridge *Multisectoral Dynamic Model* to specify employment by sector as a function of sector output, sector capital stock, and sector wage rates normalized by the price of sectoral output. The changing sectoral distribution of employment over the sample period reflects the influence of these factors.

The remainder of the supply side of the model deals with money wage rate and price determination by sector. Although structural change is not usually discussed in terms of these variables, they play important roles in determining the sectoral distribution of employment and final expenditure.

Wage rate equations in the market sector, namely goods and commercial services, explain average weekly wages in terms of Phillips curves incorporating both price expectations and productivity growth. Unemployment,

specifically the unemployment rate relative to an estimated natural unemployment rate, and expected inflation impact on money wage rates as theory suggests. Productivity growth plays a strong role in both these sectors affecting money wage rates positively. In both sectors dummy variables are used to account for the effect of the wage controls in the Anti-Inflation Program of 1975-78.

Wage determination in the non-market, noncommercial service sector is explained differently. In this case relative wage rate effects are important. Noncommercial-service-sector wage rates are explained by wage rates in commercial services lagged one quarter, and a further expected inflation effect.

Finally, the price variables of aggregate supply are explained sequentially from sectoral GDP deflators based on factor costs to market price deflators for consumer expenditure by sector and the consumer price index. Rates of change in GDP deflators for each sector are driven by lagged rates of change in own-sector unit labour costs. Consumer expenditure deflators for goods and for services are explained in turn by the behaviour of GDP deflators by sector augmented by indirect tax rate effects, import price effects, and the influences of demand pressure. The latter effects are captured by variations in consumer expenditures relative to trend. Consumer expenditures on goods and on services then combine to provide the basis for the consumer price index.

Thus the supply side of the model provides a disaggregated determination of the output and employment aspects of economic structure and structural change. This disaggregation extends as well to explanations of wages and prices, which feed in turn into incomes. Incomes are major determinants of aggregate expenditure as discussed in the next section.

Aggregate Demand – Expenditure on Final Goods and Services

The third major dimension of macroeconomic structure and structural change, in addition to the output and employment dimensions discussed above, is the structure of demand. As defined earlier, demand in this model is based on the expenditure approach to measuring GDP. That approach classifies consumer expenditure, exports, and imports into goods and service categories. We build on that base by defining capital expenditures as expenditures on goods and dividing government current expenditures between goods and services according to input-output table coefficients. The result is an aggregate demand function for final goods, and an aggregate demand function for final services.

Several components of aggregate expenditure are exogenous to the structure of the model. Government expenditures, both current and capital, fall

into this category and are allocated between types of expenditure as mentioned. Also, exports are exogenous with the National Accounts classification of exports of goods and of services used to distribute them between sectoral demand functions. This leaves consumption expenditures, private investment, residential construction, and imports to be explained by behavioural equations.

Personal consumption expenditures on goods and on services are explained by separate equations. In the case of expenditure on goods, real personal disposable income and real net financial wealth have the expected positive effects. In addition, recognizing the durable goods component of personal expenditure and the potential role of cyclical variations in income provides roles for interest rates and unemployment rates as explanatory variables. A relative price variable, goods prices to service prices, is used in the goods expenditure equation to allow for the price effects cited in other studies [Fuchs, 1968; Gershuny and Miles, 1983; Kravis, *et al.* 1983; Inman, 1985] as important determinants of demand structure and evolution.

Personal expenditure on services is explained by a much simpler equation. Real disposable income and real net financial wealth are the main determinants of expenditure. In this case, however, expenditures respond more slowly to changes in income and wealth. A lagged dependant variable is used to capture this slower response or greater stability. Thus the distribution of total expenditures between expenditures on goods and on commercial services is in part explained by the differences between the determinants of personal expenditure on goods and on services.

Gross private investment (*XIME*) is a second component of the demand for final goods explained within the model. In this investment function real output growth has a strong and persistently positive effect on expenditures on machinery, equipment, and nonresidential construction. Real interest rates, as expected, play a negative role. Dummy variables account for the stimulus to investment expenditures arising from energy prices and projects in the 1975-80 period. These relationships reinforce the roles of income and interest rates as determinants of the demand for goods.

Residential construction provides a further link between income, interest rates, and goods demand. Investment in residential construction (*XIRC*) is explained by real disposable income and nominal medium-term interest rates. A dummy variable captures the impacts of incentive programs introduced by federal and provincial governments in the mid-1970s.

Finally, imports of goods and of services reduce the share of final expenditure, that is, demand for domestically produced goods and services. In the model, expenditures on imports of goods are determined by import prices

relative to domestic prices and by the level of domestic aggregate expenditure. Imports of services are explained by domestic aggregate expenditure alone, without a significant role for relative prices. However, differences in the magnitude of imports of goods relative to services, and in the determinants of imports by sector, play a role in the distribution of final expenditure between goods and services.

In short, the aggregate demand side of the model uses simple and conventional expenditure relationships to explain expenditures on final goods and final services. The latter category includes both commercial and non-commercial services. The results are an aggregate demand for goods explained by income, wealth, relative prices, and interest rates, as well as exogenous government expenditures and exports. Similarly, aggregate demand for services is explained by income, wealth, government expenditure, and exports. Differences between sectors in the determination of aggregate expenditure explain the dynamics and evolution of demand structure. These demand patterns feed in turn into the determination of sector outputs as explained above in terms of the aggregate supply side of the model.

Model Structure, Parameters, and Structural Change

The equations of the model were estimated using quarterly seasonally adjusted data for the period 1967 (Q1) to 1986 (Q4). Most of the data are drawn directly from Statistics Canada's CANSIM data base. The exceptions are the data on employment by sector, which were prepared specifically for this study with the assistance of the Economic Council of Canada and Statistics Canada, and the natural unemployment rate series calculated by the authors. A complete data set is available from the authors on request.

The equations estimated in the model, as presented in the appendix, explain economic behaviour and sector-specific behaviour of various components. The parameters in these equations, particularly for sector outputs, employment, and expenditure, are of particular interest. They reflect the model's contribution to explaining the process of structural change.

Consider first the determination of output by sector. In the model output is demand determined. But, as observed in Table 1, the structure of final expenditure is remarkably stable over the sample period – more stable than the structure of output or employment. Thus the demand for output by sector must be derived in part through complementarity in final expenditure as mentioned above, and in part through exogenous shifts at the intermediate input level. Unfortunately, evidence on both complementarity and exogenous shifts is weak.

As parameters in the output equations illustrate, own-sector final expenditure is the predominant demand determinant of output. There is some evidence that growth in final expenditure on services, *XGNS*, has a lagged positive effect on goods-sector output growth, and similar but weaker evidence of a positive effect of goods-sector expenditure growth on commercial-services output growth. But there is not strong support for complementarity between sectors that might explain shifts in output structure relative to expenditure structure. Likewise in the noncommercial services sector, own-sector expenditure, namely government current expenditure, is the major explanatory variable. Nevertheless, the commercial-service-sector output growth rate remains substantially above output growth rates in the other sectors in the face of final demand stability.

These observations and results point towards an exogenous element in demand structure not explained by final expenditure and sector output variables. Shifts in the intermediate use of service-sector outputs in goods production and sales would be such a factor. It clearly warrants further investigation.

A second major point of interest in the parameter estimates of the output sector is cyclical sensitivity. The sensitivity of goods-sector output to its own-sector expenditure change is much higher than that in the other sectors. Thus even if sectoral expenditures experience the same degree of cyclical variation, fluctuations in goods-sector output will exceed fluctuations in the service-sector output. This implies that short-run observations on output measures of economic structure will reflect business cycle stages, as argued by Rowthorn and Wells [1987], in addition to longer term factors.

Differences among sectors in the determination of employment levels appear clearly in the estimated equations. Three symmetrical equations explain employment in terms of own-sector output, real wage rate, and capital stock. Employment in each sector is about equally sensitive to sectoral output variation. Noncommercial-service-sector employment is a little less sensitive to real wage costs, defined as a ratio of sectoral money wage rate and sectoral price, than other sectors but again differences are relatively small.

Different effects of capital stock on sectoral employment are the most dramatic and important explanations of different sectoral employment patterns. Parameters estimates show that capital accumulation reduces employment in goods-producing industries but expands employment in both commercial- and noncommercial-service producing industries. Capital and the embodied changes in production technology displace labour in goods production pushing up the capital/labour ratio and labour productivity. In other words, robots replace assembly-line workers.

On the other hand, increased capital stock increases employment in the service sectors. In commercial services, for example, new facilities such as

hotels, restaurants, airplanes, banking offices, and shopping malls must be staffed. They do not, on balance, displace labour in the production of commercial services. Some capital equipment is potentially labour saving, microcomputers for example, but is also output augmenting as accountants and financial consultants, product designers, and graphic designers can increase the range of service they deliver at the same cost, rather than holding output constant and reducing labour inputs. Thus the positive relationship between capital stock and commercial-service-sector employment is not counterintuitive.

Similarly, in noncommercial services, the employment-increasing effects of increased capital stock is intuitively plausible. New schools, hospitals, airports, and recreation facilities create demands for new staff. Labour may work more efficiently to deliver services from new and expanded facilities, but increased capital stock appears to be output augmenting rather than labour displacing. However, in the case of noncommercial services, capital accumulation is the result of government policy decisions, and employment in turn is linked to budget constraints established by government policy. By contrast, capital accumulation and its employment effects are responses to market forces in goods and commercial services.

Other studies explain differentials in sectoral employment growth by differentials between sectoral output and sectoral labour productivity growth rates. In other words, the goods-sector share in total employment declines because goods-sector labour productivity grows faster relative to goods-sector output than does labour productivity in services relative to service-sector output. Our results are consistent with this view, especially in that capital displaces labour in the goods-producing sector. However, it appears that the higher rates of output growth in commercial services, when the economy grows, combined with the positive effects of capital accumulation, would shift the distribution of employment towards commercial services even with the same rate of productivity growth in both sectors. Indeed, the earlier observation of higher productivity growth in commercial services and growing commercial-service share of employment in Table 1 is explained by growth in commercial-service-sector capital stock during that period. Thus the productivity growth rate differential explanation of structural change conceals the important differences in production technology, capital stock, and output growth that explain service-sector employment growth.

The impacts of productivity growth rate differentials enter the explanation of structural change in a different way in the model. As the wage equations illustrate, productivity growth plays a strong role in money wage rate determination. Its impact on employment flows through the wage rate variables already noted in the employment equations.

Average weekly wages in both goods and commercial service sectors are explained by unemployment, expected inflation, and productivity growth. A

small but important difference between sectors is found in the sensitivity of wage rates to unemployment, or more explicitly the measured unemployment rate relative to the natural rate. Goods-sector wages are more sensitive to unemployment than commercial-service-sector wages, as could be anticipated from the greater cyclical variation in goods-sector employment. A rise in the unemployment rate means more slack in the goods-sector demand and employment than in the service sectors, and thus more wage rate flexibility.

By contrast, service-sector wage rates are more sensitive to expected inflation and own-sector productivity growth than are goods-sector wage rates. However, on average over the sample period goods-sector wage rates have grown faster than commercial-service-sector wage rates which, *ceteris paribus*, would produce a shift in employment away from the goods sector towards services.

In addition to output and employment, the model's equations provide detail on the determinants of final expenditure by sector and changes in the sectoral distribution of that expenditure. Some approaches argue that higher income elasticities and lower price elasticities of demand for services than for goods shift expenditure towards services as the economy grows. However, as the observations of Table 1 illustrate, the distribution of real final expenditure in Canada has been remarkably stable from 1967 to 1986. It could not therefore explain the shifts in the distribution of output and employment towards the commercial service sector. In that case, what explains this demand stability?

Equations on the demand side of the model provide some insights into the underlying causes of expenditure growth by sector. Final expenditures on services are personal consumption expenditures on services plus exports of services plus government current expenditure minus imports of services. Exports and government expenditure are exogenous, while consumer expenditure and imports depend on income and wealth. In both cases the estimated equations include lagged dependant variables on the right-hand side, indicating a gradual response to contemporary income change. This is consistent with the greater cyclical stability observed in the service sector of the economy.

Final expenditure on goods includes consumption, investment, residential construction, government capital expenditure, and exports minus imports. Government expenditure and exports are exogenous. Consumption expenditure, private investment, and residential construction are all sensitive to both income and interest rates. The estimation results suggest that growing income, *ceteris paribus*, would shift final expenditure distribution from services towards goods, initially, with some offsetting service expenditure growth over time. However, this pattern would tend to contradict the predictions about expenditure in other studies and the observed stability in expenditure shares.

The latter is explained by the effects of interest rates on the growth of expenditure on goods during a period of significant upward shifts in both nominal and real interest rates. As a result, the relatively small shifts in the distribution of expenditure in the early part of the sample period reflect growing income and stable interest rates. Expenditure shifted towards goods. From 1974 onward, however, expenditure distribution shifted slightly the other way while interest rates were high and rising.

In summary, the model's equations and parameters give a more detailed explanation of the determination of sectoral outputs, employment, and final expenditure than is offered by other approaches. They place the emphasis on the short-run dynamics of the process underlying observed longer term shifts in structure. They also reconcile some apparent anomalies between observations on structural change, income growth, and expenditure patterns in the 1967-74 period observed in Table 1.

Although the primary objective of this exercise is to explain the short-run dynamics of the process of structural change, every effort was made to attain satisfactory long-run properties in the estimated equations. The long-run marginal propensities for consumption of goods and services are 0.445 and 0.327, respectively. The overall value of *MPC*, 0.772, is close to the estimates obtained in other studies. The marginal expenditures on imports of goods and services similarly are 0.32 and 0.016, respectively. In both the demand equations, consumption and imports, relative price effects have been established in the goods-sector equations. Output equations essentially are demand determined (based on expenditures); but the specification accounts for the differential effects of separate categories of demand on each output. Input substitution between capital and labour have been clearly identified in each of the employment equations via the relative factor price variables. Finally, wage equations incorporate natural rate hypothesis and, when natural and actual rates of unemployment coincide, wage changes simply reflect changes in inflation and productivity.

The performance of the model in the ex post dynamic simulations, both within and four quarters outside the sample period, is very satisfactory. The model tracked the historical values of key aggregate and sectoral variables with acceptable levels of accuracy (details are available from the authors). It provides a framework for analysing the impacts of demand and supply changes on structure and performance.

The Structural Dynamics of Sector-Specific Demand and Supply Shocks

Four sets of simulation experiments designed to explore the dynamics of structural change were performed with the model. The first three sets of

experiments involve demand shocks that impact initially on one specific sector of the economy, either the goods sector or the commercial service sector. They originate in the exogenous export sector and in the indirect and direct tax policies of government. The fourth set of simulations involves supply shocks specific to the goods-producing and commercial-service producing sectors, originating in exogenous shifts in labour productivity in each sector, respectively. The main purpose is to trace over time the response of economic structure, measured by distributions of expenditure, employment and output, and the impact on overall economic performance in terms of growth in aggregate and per capita real GDP.

The demand shocks and changes in demand structure they represent pursue the effects of demand structure as suggested by Baumol [1967], Rowthorn and Wells [1987], and Van Gemert [1987]. Consideration of the effects of sector-specific demand shocks on aggregate economic performance extends the analysis to consider growth as well as structure.

The supply shocks reflect the productivity differential hypothesis suggested by Baumol [1967] and Baumol, *et al.* [1985] and underlying much of the theoretical argument of Rowthorn and Wells [1987]. Simulations results also shed some light on the dynamics of sector-specific productivity shocks on both economic structure and aggregate economic performance.

Both experiments have clear policy dimensions. In the first case, changes in the structure of final expenditure through government expenditure, tax, transfer, or commercial policies produce different structural and performance effects depending on the shift in expenditure structure they produce. In the second case, policies that successfully promote productivity or efficiency gains, such as commercial policy, industrial policy, competition policy, and regulation policy, will produce different structural and performance effects according to the sectoral distribution of their impacts. On the basis of results presented below, policies that shift demand to commercial services and promote commercial-service-sector productivity growth will yield larger real income, employment, and productivity gains than policies that impact initially on the goods sector.

Demand Increases by Sector

The 1981 (Q1) to 1986 (Q4) period was one of recession and recovery in Canada, as illustrated in Table 1. It was chosen for these experiments because the expansionary impact on demand they create would not produce output levels beyond the rates of capacity utilization prevailing at the beginning of the period. Nor would they push the economy or unemployment rates past full employment levels.

The demand shocks are increases in final expenditures on exports. Although they improve the balance of trade in each case, we assume the Bank of Canada pursued an exchange-rate policy that maintained exchange rates at historic levels. Thus exchange rates and interest rates are exogenous with money supply responding to the effects of increased demand. Other dimensions of government policy, tax rates, transfers, and expenditures are similarly maintained at historic levels.

The experiment involves alternatively an increase in exports of goods by $1 billion (1981 dollars), starting in the first quarter of 1981 and sustained until 1986 (Q4), and then separately, a similar increase in the exports of commercial services. These produced respectively a goods-sector and a service-sector demand shock. Selected results are summarized in Tables 2 and 3.

As the tables illustrate, these experiments produce clear and persistent shifts in the structure of final expenditure. Shifts in economic structure measured by output and employment distributions follow the shift in final expenditure structure.

The results support the demand-shifts explanation of structural change in general and, specifically, the trade balance structure argued by Rowthorn and Wells [1987]. More rapid growth in expenditure in one sector shifts output and employment distributions towards that sector.

However, the structural effects of increased expenditure on goods and on services are not symmetrical. As Tables 3 and 4 illustrate, an increase in the share of expenditures on services produces more stable and persistent shifts in the structure of the economy, measured by the distributions of employment and output. This observation is consistent with the argument that increased goods-sector output and final expenditure create increased commercial-service-sector output and employment through complementarity, bundling and intermediate input relationships between sectors to produce a more balanced growth. Increased commercial-service-sector output is not linked as strongly to goods-sector output, and growth resulting from its expansion is therefore more unbalanced.

The effects of positive sector-specific demand shocks on sectoral and aggregate economic performance also differ in important ways. The service-sector demand shock output multiplier is larger, as illustrated in the lower parts of Tables 2 and 3, and more concentrated in that sector. Increased service-sector exports also result in increased employment in commercial services, but absolute declines in employment in other sectors. The spillover of demand growth into other sectors is not sufficient to offset the impacts of aggregate employment growth on money wage rates. Viewed alternatively, the goods-sector demand shock does spill over into other sectors, perhaps for the

Table 2

Structural and Performance Effects of a $1 Billion Increase in Exports of Goods, 1981 (Q1) to 1986 (Q4)

	End of year					
	1	2	3	4	5	6
A Structural effects: changes in relative shares						
			(Per cent)			
Expenditures						
XGNG	0.17	0.16	0.15	0.14	0.13	0.13
XGNS	–0.17	–0.16	–0.15	–0.14	–0.13	–0.13
Outputs						
XGDG	0.13	0.14	0.13	0.11	0.10	0.10
XGDSC	–0.09	–0.09	–0.09	–0.08	–0.07	–0.07
XGDSN	–0.04	–0.04	–0.04	–0.03	–0.03	–0.02
Employment						
ECTG	0.07	0.07	0.06	0.05	0.04	0.03
ECTSC	–0.05	–0.04	–0.03	–0.03	–0.02	–0.01
ECTSN	–0.02	–0.02	–0.02	–0.02	–0.02	–0.02
B Performance effects: changes from 1981 base values						
			(Billions of 1981 dollars)			
Output						
XGDP	1.10	1.22	1.18	1.12	1.06	0.99
XGDG	0.83	0.90	0.85	0.80	0.76	0.72
XGDSC	0.19	0.24	0.25	0.23	0.21	0.19
XGDSN	0.07	0.09	0.09	0.09	0.09	0.09
			(Thousands)			
Employment						
ECTG	12.2	12.8	11.5	10.0	8.7	7.8
ECTSC	2.7	3.8	4.4	4.8	5.1	5.5
ECTSN	1.2	1.3	1.2	1.1	1.0	1.0
ECT	16.1	17.9	17.1	15.9	14.9	14.4
			(Per cent change)			
Productivity						
XGDP	0.19	0.21	0.19	0.18	0.16	0.15

reasons discussed earlier in considering structural effects, producing slow but more balanced output and employment effects. Finally, the expansionary effect of a service-sector demand shock on aggregate productivity, as measured by real GDP per employee, is larger than that of a goods-sector demand shock.

Table 3

Structural and Performance Effects of a $1 Billion Increase in Exports of Services, 1981 (Q1) to 1986 (Q4)

	End of year					
	1	2	3	4	5	6
A Structural effects: changes in relative shares						
			(Per cent)			
Expenditures						
XGNG	–0.11	–0.11	–0.13	–0.13	–0.13	–0.13
XGNS	0.11	0.11	0.12	0.13	0.13	0.13
Outputs						
XGDG	–0.05	–0.04	–0.05	–0.06	–0.07	–0.07
XGDSC	0.12	0.12	0.13	0.13	0.12	0.12
XGDSN	–0.07	–0.08	–0.07	–0.07	–0.06	–0.05
Employment						
ECTG	–0.01	–0.02	–0.03	–0.04	–0.04	–0.05
ECTSC	0.05	0.06	0.07	0.07	0.08	0.08
ECTSN	–0.04	–0.04	–0.04	–0.04	–0.03	–0.03
B Performance effects: changes from 1981 base values						
			(Billions of 1981 dollars)			
Output						
XGDP	1.29	1.36	1.24	1.13	1.03	0.95
XGDG	0.32	0.36	0.27	0.19	0.14	0.10
XGDSC	0.96	1.00	0.98	0.95	0.92	0.88
XGDSN	0.00	0.00	–0.01	–0.02	–0.03	–0.03
			(Thousands)			
Employment						
ECTG	4.1	4.0	2.1	0.5	–0.7	–1.6
ECTSC	14.1	15.1	15.4	15.3	15.2	15.3
ECTSN	–0.3	–0.4	–0.7	–0.9	–1.1	–1.1
ECT	17.9	18.8	16.8	14.9	13.5	12.6
			(Per cent change)			
Productivity						
XGDP	0.23	0.24	0.21	0.19	0.17	0.15

Tax-Induced Demand Decreases

Sector-specific increases in indirect taxes produce negative demand shocks with sectoral impacts of different magnitudes and patterns. Their effects on economic structure and performance are different from those observed in the

Table 4

Price Effects of Sector-Specific Increases in Indirect Taxes by 1 Per Cent

	End of year					
	1	2	3	4	5	6
Goods-sector indirect tax increase						
PCEG	0.87	0.71	0.50	0.28	0.06	–0.13
PCES	–0.03	–0.14	–0.37	–0.64	–0.94	–1.23
PGNP	0.57	0.43	0.26	0.05	–0.16	–0.36
PCPI	0.49	0.35	0.13	–0.12	–0.37	–0.62
Commercial-service-sector indirect tax increase						
PCEG	–0.02	–0.02	–0.07	–0.15	–0.24	–0.34
PCES	0.98	0.92	0.77	0.56	0.30	0.03
PGNP	0.61	0.61	0.54	0.45	0.33	0.21
PCPI	0.39	0.37	0.29	0.16	–0.01	–0.18

preceding experiments. The indirect tax changes operate through the price system in the model to change the relative prices of goods and commercial services. Impacts on the consumer price index also reduce real disposable income. The simulation results illustrate the initial substitution and income effects of these tax-induced price changes, and the structural and performance consequences of the dynamics of subsequent adjustment. Changes in direct taxes, by contrast, change real disposable income but not prices. The simulation illustrates the pattern and effect of the resulting change in consumer demand and the dynamics of adjustment.

As in the export shock experiments just described, it is assumed that monetary and exchange rate policy accommodate the effects of the tax changes introduced in these experiments. In addition it is assumed that the increased revenue generated by the tax increases is used to reduce the government sector's budget deficit, not to finance new expenditure.

Consider the indirect tax increases first. Tables 4, 5 and 6 summarize the results. Indirect tax rate increases produce sharp price increases in the sector to which they are applied, changes in relative prices, *PCEG/PCES*, and an increase in general price levels, *PGNP* and *PCPI*. These price effects dissipate over time as a result of the contractionary effect they have on economic

activity, and the wage and price dynamics that follow. Table 4 gives a summary of the price effects.

A comparison of Tables 5 and 6 illustrates the differences that result from increases in indirect taxes on different sectoral bases. The demand shocks are different and the economy's structural and performance responses differ

Table 5

Structural and Performance Effects of Increased Indirect Ta of 1 Per Cent on Goods-Sector Output

	End of year					
	1	2	3	4	5	6
A Structural effects: changes in relative shares						
	(Per cent)					
Expenditures						
XGNG	–0.19	–0.17	–0.12	–0.08	–0.05	–0.02
XGNS	0.19	0.17	0.13	0.08	0.05	0.03
Outputs						
XGDG	–0.17	–0.17	–0.13	–0.10	–0.07	–0.04
XGDSC	0.09	0.07	0.04	0.01	–0.01	–0.02
XGDSN	0.08	0.09	0.09	0.08	0.07	0.06
Employment						
ECTG	–0.09	–0.08	–0.06	–0.04	–0.02	0.00
ECTSC	0.05	0.03	0.01	–0.01	–0.03	–0.05
ECTSN	0.04	0.05	0.05	0.05	0.05	0.04
B Performance effects: changes from base values						
	(Billions of 1981 dollars)					
Output						
XGDP	–1.35	–1.66	–1.73	–1.69	–1.58	–1.38
XGDG	–0.96	–1.08	–1.03	–0.94	–0.83	–0.66
XGDSC	–0.31	–0.49	–0.61	–0.67	–0.69	–0.67
XGDSN	–0.08	–0.09	–0.09	–0.07	–0.06	–0.05
	(Thousands)					
Employment						
ECTG	–16.0	–17.0	–15.0	–11.0	–8.0	–5.0
ECTSC	–6.0	–8.0	–11.0	–12.0	–12.0	–13.0
ECTSN	–2.0	–1.0	–1.0	0.0	0.0	0.0
ECT	–23.0	–26.0	–26.0	–23.0	–21.0	–18.0
	(Per cent change)					
Productivity						
XGDP	–0.28	–0.35	–0.36	–0.34	–0.31	–0.27

accordingly. Increased indirect taxes on goods have larger effects on both structure and performance than do those on commercial services. This is in part because the substitution and income effects are re-enforcing in the goods sector, and in part because of the greater short-run sensitivity of that sector to demand shocks, as observed in the previous simulations.

Table 6

Structural and Performance Effects of Increased Indirect Tax of 1 Per Cent on Commercial-Service-Sector Output

	End of year					
	1	2	3	4	5	6
A Structural effects: changes in relative shares						
			(Per cent)			
Expenditures						
XGNG	–0.04	–0.04	–0.02	–0.01	0.01	0.03
XGNS	0.04	0.04	0.03	0.01	–0.01	–0.03
Outputs						
XGDG	–0.04	–0.05	–0.05	–0.03	–0.02	–0.01
XGDSC	0.01	0.00	–0.01	–0.03	–0.04	–0.05
XGDSN	0.03	0.05	0.06	0.06	0.06	0.06
Employment						
ECTG	–0.02	–0.03	–0.03	–0.02	–0.01	0.00
ECTSC	0.01	0.00	0.00	–0.01	–0.02	–0.03
ECTSN	0.01	0.02	0.03	0.03	0.04	0.04
B Performance effects: changes from base values						
			(Billions of 1981 dollars)			
Output						
XGDP	–0.47	–0.77	–1.01	–1.16	–1.22	–1.19
XGDG	–0.29	–0.43	–0.52	–0.55	–0.55	–0.48
XGDSC	–0.16	–0.31	–0.46	–0.37	–0.65	–0.69
XGDSN	–0.02	–0.03	–0.04	–0.03	–0.03	–0.03
			(Thousands)			
Employment						
ECTG	–5.0	–7.0	–8.0	–7.0	–6.0	–5.0
ECTSC	–3.0	–5.0	–7.0	–8.0	–9.0	–10.0
ECTSN	–1.0	0.0	0.0	0.0	1.0	1.0
ECT	–9.0	–12.0	–15.0	–15.0	–15.0	–14.0
			(Per cent change)			
Productivity						
XGDP	–0.09	–0.16	–0.21	–0.24	–0.25	–0.24

The longer term effects of the indirect tax increases are shifts in the distribution of expenditure and output away from the sector on which the increased tax has been imposed. In both cases, however, by the end of the simulation period, employment effects are concentrated in the commercial service sector. The significance of this result rests on the role and importance of the commercial service sector in aggregate economic growth and in productivity growth. This remains a topic of considerable debate, but if the commercial service sector plays a key role in the productivity growth – "positive deindustrialization" process – as some recent work suggests, the longer term contractionary effects of indirect tax increases could reduce growth potential regardless of the sectoral output on which they are imposed.

Nevertheless it is clear from the results of these experiments that indirect tax changes applied to service sector outputs cause less disruption to the structure and the level of economic activity than indirect tax increases applied to goods-sector output. The commercial service sector accounted for a larger share of real GDP than did the goods sector when the indirect tax increases were introduced. The commercial-service-sector tax increase thus has larger government revenue, GDP price, and relative price effects than a goods-sector tax increase of the same magnitude. But because services have a smaller share in final expenditure than goods, and because expenditure on services has lower price and income elasticity, the impact of the service-sector tax increase on demand structure is less, its contractionary impact is less, and its inflationary potential is greater. These results mean that the design and implementation of tax policy has important structural and related performance dimensions. They also illuminate a role for sectoral differences in income and price elasticity of expenditure that in the short run is the reverse of that observed by Baumol [1967], Fuchs [1968], and more recent work in a long-run general equilibrium context.

The effects of increased direct taxes on economic structure and performance are summarized in Table 7. The initial effect is predominantly on income, and shifts the distribution of expenditure away from the goods sector. Structural change in output and employment follows the shift in expenditure distribution. In this case, however, the initial structural effects are relatively short-lived. They are reversed during the adjustment to lower levels of economic activity. Once again it is the commercial service sector that bears most of the adjustment in terms of reduced levels of output and employment.

These tax simulations provide a different set of demand shocks than those illustrated by the previous export simulations. Changes in exports produce direct sector-specific demand shocks. Changes in taxes produce price- and income-induced demand shocks. The tax changes impact initially on expenditure on goods in each case because the short-run price and income elasticities of expenditure are higher in the goods sector. In the case of indirect tax

Table 7

Structural and Performance Effects of Increased Direct Taxes by 10 Per Cent from Historical Rates

	End of year					
	1	2	3	4	5	6
A Structural effects: changes in relative shares						
	(Per cent)					
Expenditures						
XGNG	–0.36	–0.34	–0.15	0.00	0.12	0.20
XGNS	0.36	0.33	0.17	0.00	–0.13	–0.19
Outputs						
XGDG	–0.34	–0.35	–0.25	–0.13	–0.02	0.05
XGDSC	0.16	0.09	–0.03	–0.14	–0.22	–0.27
XGDSN	0.18	0.26	0.28	0.27	0.24	0.22
Employment						
ECTG	–0.17	–0.16	–0.09	0.00	0.08	0.15
ECTSC	0.08	0.03	–0.06	–0.16	–0.23	–0.30
ECTSN	0.09	0.14	0.16	0.16	0.15	0.15
B Performance effects: changes from base values						
	(Billions of 1981 dollars)					
Output						
XGDP	–3.05	–4.40	–4.90	–4.83	–4.47	–4.03
XGDG	–2.04	–2.61	–2.58	–2.25	–1.80	–1.36
XGDSC	–0.85	–1.58	–2.13	–2.44	–2.58	–2.61
XGDSN	–0.17	–0.21	–0.19	–0.14	–0.89	–0.58
	(Thousands)					
Employment						
ECTG	–33.0	–39.0	–34.0	–23.0	–12.0	–3.0
ECTSC	–15.0	–28.0	–40.0	–47.0	–53.0	–58.0
ECTSN	–2.0	–2.0	–1.0	1.0	2.0	3.0
ECT	–50.0	–70.0	–75.0	–70.0	–63.0	–58.0
	(Per cent change)					
Productivity						
XGDP	–0.66	–0.93	–1.00	–0.93	–0.83	–0.72

increase, the structural effects are different by sector taxed but are relatively short-lived. In the case of direct tax increase, the structural effects are stronger, more durable, and ultimately depress the commercial service sector both absolutely and relative to other sectors.

In summary, demand structure and changes in that structure are important determinants of employment and output structure in the aggregate economy. Structural change is driven more strongly and persistently by shifts in final expenditure towards services. An increased share of expenditure on services also contributes more strongly to aggregate economic performance, measured in terms of output growth and productivity increases. On the other hand, growth in final expenditure on goods results in a more balanced longer term expansion in economic activity. Demand reductions induced by tax increases confirm these structural and performance observations, and illustrate the implications of different tax policies and negative demand shocks.

Thus the evolution of demand structure as the economy grows, or exogenous shifts in demand structure, which might be policy induced, play an important role in the short-run dynamics and longer term pattern of structural change. The 1967-74 period in Canada provides an example of a shift in final expenditure structure towards goods, led by the export sector, but balanced in part by rapid growth in government current expenditure. The result was structural change accompanied by strong growth and productivity gains: a period of "positive deindustrialization." Subsequent periods of relatively stable expenditure structure were also times of lower aggregate output and productivity growth. But the most important results from these experiments are the larger multiplier, productivity, and structural effects caused by demand shocks that directly affect the service sector, and the predominance of goods-demand effects from tax changes.

Productivity Increases by Sector

The period 1974-80 was one of relatively low productivity growth in the Canadian economy, as illustrated in Table 1. Accordingly, this subperiod was chosen for experiments that involve increased productivity growth by sector. The productivity changes used in the simulations do not result in productivity levels or growth rates outside the range of sample period experience.

These experiments consider the effects of sector-specific increases in labour productivity. Productivity change was introduced into a specific sector, for example the goods-producing sector, by replacing the employment equation for that sector with an identity giving employment based on output and output per employee. Then two model solutions were derived. The first based on historical output/employee in the target sector provided a base solution. The second, based on productivity 1-per-cent higher than its historical values in each quarter, 1974 (Q1) to 1980 (Q4), captured the effect of sector-specific productivity change. Differences between these solutions provide measures of the effects of the productivity increases. Tables 8 and 9 present a selection of results.

Table 8

Structural and Performance Effects of a 1-Per-Cent Increase in Goods-Sector Labour Productivity from Historical Values, 1974 (Q1) to 1980 (Q4)

	End of year						
	1	2	3	4	5	6	7
A Structural effects: changes in relative shares							
				(Per cent)			
Expenditures							
XGNG	–0.07	–0.10	–0.07	–0.01	0.03	0.03	0.01
XGNS	0.07	0.10	0.07	0.01	–0.03	–0.03	–0.01
Outputs							
XGDG	–0.06	–0.09	–0.07	–0.02	0.01	0.02	0.00
XGDSC	0.03	0.05	0.03	–0.01	–0.03	–0.03	–0.02
XGDSN	0.03	0.05	0.05	0.03	0.02	0.01	0.02
Employment							
ECTG	–0.29	–0.33	–0.31	–0.26	–0.22	–0.21	–0.22
ECTSC	0.19	0.21	0.19	0.14	0.12	0.11	0.11
ECTSN	0.10	0.12	0.12	0.11	0.10	0.10	0.11
B Performance effects: changes from 1974 base values							
				(Billions of 1981 dollars)			
Output							
XGDP	–0.44	–0.81	–0.81	–0.54	–0.26	–0.25	–0.48
XGDG	–0.32	–0.56	–0.51	–0.28	–0.06	–0.04	–0.18
XGDSC	–0.10	–0.21	–0.27	–0.24	–0.20	–0.20	–0.29
XGDSN	–0.03	–0.05	–0.04	–0.02	0.00	–0.00	–0.01
				(Thousands)			
Employment							
ECTG	–40.0	–47.0	–45.0	–38.0	–37.0	–40.0	–45.0
ECTSC	–1.0	–3.0	–5.0	–6.0	–7.0	–9.0	–12.0
ECTSN	0.0	0.0	0.0	1.0	1.0	1.0	1.0
ECT	–42.0	–50.0	–50.0	–44.0	–43.0	–48.0	–56.0

The structural effects of sector-specific productivity increases have two distinct dimensions. The productivity increases in the absence of exogenous demand shifts produce a change in the composition of final expenditure. At the same time, altered productivity levels and growth rates have effects on the distribution of employment. The results allow us to examine both these aspects of the economy's response to productivity shocks.

Table 9

Structural and Performance Effects of a 1-Per-Cent Increase in Commercial-Service-Sector Labour Productivity from Historical Values, 1974 (Q1) to 1980 (Q4)

	End of year						
	1	2	3	4	5	6	7
A Structural effects: changes in relative shares							
	(Per cent)						
Expenditures							
XGNG	–0.08	–0.10	–0.07	–0.01	0.03	0.05	0.07
XGNS	0.08	0.10	0.07	0.01	–0.03	–0.05	–0.07
Outputs							
XGDG	–0.07	–0.10	–0.07	–0.02	0.02	0.04	0.06
XGDSC	0.04	0.05	0.03	0.00	–0.02	–0.04	–0.04
XGDSN	0.03	0.05	0.04	0.02	0.01	0.00	–0.01
Employment							
ECTG	0.13	0.13	0.15	0.18	0.21	0.23	0.24
ECTSC	–0.24	–0.26	–0.28	–0.29	–0.30	–0.31	–0.32
ECTSN	0.11	0.13	0.13	0.12	0.12	0.08	0.08
B Performance effects: changes from 1974 base values							
	(Billions of 1981 dollars)						
Output							
XGDP	–0.53	–0.80	–0.72	–0.43	–0.09	0.14	0.31
XGDG	–0.39	–0.56	–0.46	–0.23	0.02	0.18	0.30
XGDSC	–0.12	–0.20	–0.22	–0.18	–0.11	–0.06	–0.01
XGDSN	–0.03	–0.04	–0.04	–0.02	0.00	0.01	0.03
	(Thousands)						
Employment							
ECTG	–6.0	–7.0	–4.0	1.0	7.0	11.0	14.0
ECTSC	–44.0	–48.0	–48.0	–49.0	–49.0	–50.0	–50.0
ECTSN	0.0	0.0	0.0	1.0	1.0	1.0	1.0
ECT	–50.0	–55.0	–52.0	–48.0	–41.0	–38.0	–34.0

The structural change in expenditure and output reflects the endogenous demand effects of increased sectoral productivity. Productivity growth displaces labour in the sector of incidence, reduces labour income and real disposable income, and thereby reduces final expenditure based on the income and price elasticities of expenditure. In both cases, a goods-sector productivity increase and a commercial-service-sector productivity increase, the effects

on the structure of final expenditure are very similar over the first four years. Expenditure and output shift away from goods and towards services. Subsequent dynamics reverse these structural effects. While they virtually disappear in the case of goods-sector productivity change, they persist as increased expenditure and output shares for goods in the case of commercial-service-sector productivity increases. Thus the final demand effects of increased productivity dominate the observations on structure in terms of the distributions of final expenditure and outputs by sector, and the short-run effects are the same in both cases. On the other hand, the structural effects on employment distribution follow precisely the predictions of earlier work such as Baumol [1967] and Baumol, *et al.* [1985]. Employment shifts strongly away from the sector of increased productivity growth. Thus increased goods-sector productivity growth relative to other sectors reduces goods-sector employment relative to other sectors as illustrated in Table 8. Similarly, increased commercial-service-sector productivity shifts employment away from that sector as illustrated in Table 9.

But the aggregate income effects of these employment shifts are what drive the other measures of structural change. In the case of commercial-service-sector productivity change they support a shift in expenditure towards the goods sector that is strong enough to offset the initial contractionary effects and produce an absolute increase in goods-sector employment, not just an increase in its share of total employment. In the goods-sector case, the distributions of expenditure and output show only short-term disturbance. Thus commercial-service-sector productivity shocks have stronger and more durable structural effects.

The performance effects of increased productivity, in both cases, are dominated by its initially contractionary impacts on employment and labour income. Exogenous demand factors take historical values through these experiments with the result that productivity growth produces "technological unemployment." The contractionary effect is initially larger in the case of the commercial service sector because that sector is larger, as noted in Table 1, and thus the labour displacement effect is larger. However, this also results in larger price effects, as presented in Table 10, which help to offset the contractionary effects through their impacts on real income and domestic expenditure, and through price and income effects on the balance of trade. As a result, in the case of commercial-service-sector productivity increase, the aggregate economy recovers within the simulation period to yield increased real GDP based on increased demand for goods, goods-sector output and goods-sector employment.

These results suggest that commercial-service-sector productivity improvements have the potential to yield larger performance benefits to the aggregate economy than do similar goods-sector productivity improvements. This

Table 10

Price Effects of Sector-Specific Increases in Labour Productivity, 1974 (Q4) to 1980 (Q4)

	End of year					
	1	2	3	4	5	6
	(Per cent change from base value)					
Goods-sector indirect tax increase						
PCEG	–0.12	–0.26	–0.50	–0.75	–0.98	–1.24
PCES	–0.03	–0.16	–0.38	–0.60	–0.82	–1.04
PGNP	–0.36	–0.71	–1.06	–1.36	–1.75	–2.29
PCPI	–0.08	–0.22	–0.45	–0.68	–0.91	–1.15
Commercial-service-sector indirect tax increase						
PCEG	–0.13	–0.45	–0.75	–1.03	–1.26	–1.50
PCES	–0.20	–0.47	–0.72	–0.94	–1.13	–1.30
PGNP	–0.52	–1.02	–1.45	–1.78	–2.19	–2.58
PCPI	–0.17	–0.46	–0.74	–0.99	–1.20	–1.40

difference is, in part, a result of the larger size of the commercial service sector in terms of employment and output, and in part a result of higher ratios of value-added to final sales in that sector. Productivity increases produce larger employment effects and larger initial price level effects as a result. These effects spread to other sectors through demand patterns, wage rate adjustments, and price effects.

The policy implications of such a result are significant. Policy initiatives such as deregulation seek in part to promote efficiency gains in commercial service sectors such as transportation and financial institutions. To the extent that they succeed, they stimulate the aggregate economy through linkages to goods-sector employment and output. At the same time, they create room for expansionary demand policy (or exogenous demand growth) to enhance aggregate output further within easier inflation and balance-of-payments constraints.

Conclusions

This paper has considered the short-run aspects of structural change in the Canadian economy in the context of a small, three-sector macroeconomic

simulation model. The model has served several important purposes. It has provided a framework within which the sector-specific supply and demand dimensions of economic structure and performance can be defined and interrelated. The estimation of parameters for behavioural equations in the model has provided a set of empirical tests of the importance of a wide range of potential causal factors contributing to the process of structural change. The estimated parameters themselves provide information on the relative strengths of different factors as determinants of different dimensions of structural change. And finally, simulation experiments using the model provide new information on the structural effects of sector-specific demand and supply shocks, the short-run dynamics of adjustment that include structural change, and the linkages between structural change and economic performance.

The model's structure and estimation has reinforced the importance of both supply- and demand-side factors identified in previous work as causes of structural change. But by considering these factors in greater detail and in a dynamic context, it provides a richer description of the reasons for the observed stability in the structure of final expenditure and of the causes of change in the structure of output and employment. As a result, sectoral differentials in income and price elasticities of demand and in labour productivity growth rates have a lesser explanatory role than they have played previously. Exogenous shifts in demand for sector outputs at intermediate rather than final output stages, reflecting increased sectoral specialization and contracting out, assume a larger explanatory role as more recent work on structural change anticipates. The underlying cause of long-run structural change is evolving sectoral comparative advantage which draws forth shifts in the demands for sectoral outputs and shifts in sectoral labour productivity growth rate differentials.

Nevertheless, exogenous shifts in the structure of final expenditure and in sectoral productivity have strong short-run impacts on economic structure and performance. The design and the structure of the model allows exogenous demand shocks or exogenous productivity increases to be focused specifically on one sector of the economy. Simulation experiments with the model illustrate that shocks to expenditure have effects on structure and performance that are sensitive to the sector of initial impact. While the absolute magnitude of these shock effects may be exaggerated by the structural disaggregation in the model, their directions and relative magnitudes are clear. Furthermore, productivity shocks have effects on structure and performance that differ according to the sector of initial impact. These results are significant in terms of their policy implications. Policies that shift demand to commercial services, and/or promote commercial-service-sector productivity growth, yield larger real income, employment, and aggregate productivity gains than those impacting initially on goods.

In more general terms, the results presented here confirm that structural change and economic growth are strongly and positively interrelated. Policies aimed at economic stability and efficiency create conditions conducive to structural change, and structural change in turn is a response to opportunities to improve economic efficiency. This is the process that has been called "positive deindustrialization." It is also clear that periods of retarded or stagnant economic growth may be associated with service-sector growth that does not contribute to aggregate economic performance. This is the process sometimes referred to as "negative deindustrialization."

A Definition of Variables

Name	Type[1]	Definition	
APRT	B	Average (total) participation rate	Ratio
ECT	I	Employment – total (civilian)	Millions
ECTG	B	Employment – goods	Millions
ECTS	I	Employment – services	Millions
ECTSC	B	Employment – commercial services	Millions
ECTSN	B	Employment – noncommercial services	Millions
GBT	I	Government balance	C$ millions
GET	I	Total government expenditure	C$ millions
GETR	I	Government transfer payments – total	C$ millions
GETRP	X	Government transfer payments – persons	C$ millions
GETRO	X	Government transfer payments – other transfers	C$ millions
GINV	X	Government investment income	C$ millions
GIPD	X	Interest on public debt	C$ millions
GRNT	X	Total government non-tax revenue	C$ millions
GRT	I	Total government revenue	C$ millions
LFTC	I	Labour force – total civilian	Millions
M1	B	Narrowly defined money supply	C$ millions
NPOP	X	Non-institutionalized population (15 years of age and above)	Millions
PCEG	B	Consumer expenditure deflator – goods	1981 = 1.0
PCES	B	Consumer expenditure deflator – services	1981 = 1.0
PCET	I	Consumer expenditure deflator – total	1981 = 1.0
PCPI	B	Consumer price index	1981 = 1.0
PGDG	B	Unit GDP cost index – goods	1981 = 1.0
PGDP	I	Unit GDP cost index – total	1981 = 1.0
PGDS	I	Unit GDP cost index – services	1981 = 1.0
PGDSC	B	Unit GDP cost index – commercial services	1981 = 1.0
PGDSN	B	Unit GDP cost index – noncommercial services	1981 = 1.0
PGNP	I	GNP deflator	1981 = 1.0
PGUS	X	U.S. GNE deflator	1981 = 1.0
PGT	B	Price deflator – all government expenditures (total)	1982 = 1.0
PIM	B	Import price deflator – all imports	1981 = 1.0
REX	X	Exchange rate (price of US$1)	Cdn. $
RG35	B	3-5 year government bond rate	Per cent
RITM	I	Average rate of import tariff – all imports	Ratio
RRIE	I	Expected real rate of interest	Per cent
RTB	B	Treasury bill rate	Per cent
RTBUS	X	U.S. Treasury bill rate	Per cent
RTDR	X	Direct tax rate – total	Ratio
RTIR	X	Indirect tax rate – total	Ratio
RTPTG	X	Proportion of personal taxes in all direct taxes	Ratio
RXKG	X	Proportion of capital stock in goods industry	Ratio
RXKSC	X	Proportion of capital stock in commercial service industries (as a proportion of all service industries)	Ratio

Name	Type[1]	Definition	
TCNR	X	Transfer from persons to corporations and non-residents	C$ millions
TDR	I	Government tax revenue – direct taxes (all government)	C$ millions
TFCNR	X	Transfers from corporations and non-residents	C$ millions
TIME	X	Time	1-80
TIR	I	Government tax revenue – indirect taxes (all government)	C$ millions
TPOP	X	Total population – Canada	Millions
TPTG	I	Direct taxes on persons and other transfers from persons	C$ millions
TRFP	X	All transfers from persons to all governments	C$ millions
UR	I	Unemployment rate	Per cent
URN	X	Natural rate of unemployment	Per cent
WAT	I	Average weekly wage rate – total	$
WATG	B	Average weekly wage rate – goods	$
WATS	I	Average weekly wage rate – services	$
WATSC	B	Average weekly wage rate – commercial services	$
WATSN	B	Average weekly wage rate – noncommercial services	$
XCEG	B	Consumer expenditures – goods	81$ millions
XCES	B	Consumer expenditures – services	81$ millions
XCET	I	Consumer expenditures – total	81$ millions
XGCE	X	Government current expenditures	81$ millions
XGDG	B	Real GDP – goods output	81$ millions
XGDP	I	Real GDP – total output	81$ millions
XGDS	I	Real GDP – services output	81$ millions
XGDSC	B	Real GDP – commercial services output	81$ millions
XGDSN	B	Real GDP – noncommercial services output	81$ millions
XGKE	X	Government capital expenditures	81$ millions
XGNE	I	Real GNE – total expenditures	81$ millions
XGNED	I	Real domestic product – total expenditures at market prices	81$ millions
XGNG	I	Real GNE – expenditure on goods	81$ millions
XGNS	I	Real GNE – expenditure on services	81$ millions
XGT	I	Government expenditure on goods and services	81$ millions
XGUS	X	U.S. GNE	82$ millions
XIME	B	Nonresidential construction and M&E	81$ millions
XIPV	B	Change in business inventories (excluding government)	81$ millions
XIRC	B	Residential construction	81$ millions
XITP	I	Gross private investment	81$ millions
XK	I	Capital stock – total	81$ millions
XKG	I	Capital stock – goods	81$ millions
XKS	I	Capital stock – services	81$ millions
XKSC	I	Capital stock – commercial services	81$ millions
SKSN	I	Capital stock – noncommercial services	81$ millions
XRE	X	Residual error	81$ millions

Name	Type[1]	Definition	
XTM	I	Imports – total	81$ millions
XTMG	B	Imports – goods	81$ millions
XTMS	I	Imports – services (total)	81$ millions
XTX	I	Exports – total	81$ millions
XTXG	X	Exports – goods	81$ millions
XTXS	I	Exports – services (total)	81$ millions
YBRI	B	Other incomes (interest, rent, farm and non-farm)	C$ millions
YBRT	B	Interest, dividends and other business income	C$ millions
YCCA	I	Capital consumption allowance – total	C$ millions
YCCB	X	Capital consumption allowance – business	C$ millions
YCCG	X	Capital consumption allowance – government (total) (consolidated, including federal, provincial, municipal, and hospital)	C$ millions
YCRP	B	Corporate profits	C$ millions
YCS	I	Personal savings	C$ millions
YDIS	I	Personal disposable income	C$ millions
YGNP	I	Gross national product – total	C$ millions
YGNPD	I	Gross domestic product market prices – incomes	C$ millions
YITA	I	Indirect taxes, less subsidies (including *CCA*)	C$ millions
YITS	I	Indirect taxes, less subsidies	C$ millions
YIVA	X	Inventory value adjustment	C$ millions
YLI	I	Wages and salaries and supplementary labour income	C$ millions
YMPA	X	Military pay and allowances	C$ millions
YNFA3	B	Net private wealth	C$ millions
YRE	X	Residual error	C$ millions
YSUB	X	Government subsidies	C$ millions
YWTG	I	Wages and salaries – goods industries	C$ millions
YWTS	I	Wages and salaries – all services	C$ millions
YWTSC	I	Wages and salaries – commercial services	C$ millions
YWTSN	I	Wages and salaries – noncommercial services	C$ millions

1 B: endogenous (behavioural equation) variable; I: endogenous (identity) variable; and X: exogenous variable.

B Estimated Equations

Final Demand

1. Personal Consumption Expenditures – Goods

$$XCEG/NPOP = \underset{(3.7)}{2928.62} + \underset{(19.7)}{0.44467}\,(YDIS/PCPI)/NPOP$$

$$- \underset{(2.9)}{1776.44}\,(PCEG/PCES) - \underset{(7.6)}{48.955}\,RG35_{-1}$$

$$- \underset{(5.2)}{54.6376}\,(UR_{-1} + UR_{-2} + UR_{-3} + UR_{-4})*0.25$$

$$+ \underset{(1.3)}{0.02116}\,(YNFA3_{-1}/PCPI_{-1})/NPOP_{-1}$$

$RBAR^2 = 0.97$ $\quad DW = 1.5$ $\quad SEE = 88.5$ $\quad YBAR = 5472.2$

2. Personal Consumption Expenditures – Services

$$XCES/NPOP = \underset{(0.5)}{-12.613} + \underset{(3.6)}{0.03406}\,(YDIS/PCPI)/NPOP$$

$$+ \underset{(31.9)}{0.8957}\,(XCES_{-1}/NPOP_{-1}) + \underset{(3.3)}{0.0176}\,(YNFA3_{-1}/PCPI_{-1})/NPOP_{-1}$$

$RBAR^2 = 0.99$ $\quad DW = 2.0$ $\quad SEE = 28.3$ $\quad YBAR = 4115.3$

3. Gross Private Investment

$$XIME = \underset{(0.3)}{-181.5253} + \underset{(67.7)}{1.005126}\,XIME_{-1} + \underset{(3.2)}{51.7488}*RXGDP + \underset{(3.2)}{77.6232}*RXGDP_{-1}$$

$$+ \underset{(3.2)}{77.6232}\,RXGDP_{-2} + \underset{(3.2)}{51.7488}\,RXGDP_{-3} - \underset{(1.75)}{10.552}\,RRIE - \underset{(1.75)}{17.586}\,RRIE_{-1}$$

$$- \underset{(1.75)}{21.104}\,RRIE_{-2} - \underset{(1.75)}{21.104}\,RRIE_{-3} - \underset{(1.75)}{17.586}\,RRIE_{-4} - \underset{(1.75)}{10.552}\,RRIE_{-5}$$

$$+ \underset{(7.5)}{3012.88}\,DXIM$$

$$\left[RXGDP = 100*\left(\left[XGDP/\left[\left(XGDP_{-1} + XGDP_{-2} + XGDP_{-3} + XGDP_{-4}\right)/4\right]\right] - 1\right)\right]$$

$RBAR^2 = 0.99$ $\quad DW = 1.77$ $\quad SEE = 896.9$ $\quad YBAR = 39510.2$

4. Investment in Residential Construction (AR1)

$$XIRC = 1005.69 + 0.1106\ (YDIS/PCPI) - 116.01\ RG35_{-1} - 174.01\ RG35_{-2}$$
$$(0.5)\quad (13.5)\qquad\qquad (12.3)\qquad\qquad (12.3)$$

$$- 174.01\ RG35_{-3} - 116.01\ RG35_{-4} + 1446.5\ DRESD$$
$$(12.3)\qquad\qquad (12.3)\qquad\qquad (11.3)$$

$RBAR^2 = 0.96$ $\quad DW = 2.0$ $\quad SEE = 523.9$ $\quad YBAR = 12692.8$

$RHO = 0.2886$

5. Change in Inventories (Private: Farm and Non-Farm) (AR1)

$$XIPV = - 5309.44\ (XGNG/XGDG) - 325.22\ (RG35_{-1}) + 3782.3*DINV$$
$$(1.6)\qquad\qquad (1.7)\qquad\qquad (10.0)$$

$$+ 13676.9\ (XGDG/XGDGTR)$$
$$(3.0)$$

$RBAR^2 = 0.65$ $\quad DW = 2.1$ $\quad SEE = 1781.2$ $\quad YBAR = 1001.5$

$RHO = 0.535$

6. Imports – Goods

$$XTMG = 7943.78 + 0.8457\ XTMG_{-1} - 12608.1\ (PIM/PGNP)$$
$$(1.5)\quad (18.4)\qquad\qquad (2.9)$$

$$+ 0.04947\ XGNED + 4621.02\ DXTMG$$
$$(7.8)\qquad\qquad (7.5)$$

$RBAR^2 = 0.99$ $\quad DW = 2.3$ $\quad SEE = 1849.0$ $\quad YBAR = 56536.0$

7. Imports – Services

$$XTMS = 684.85 + 0.9295\ XTMS_{-1} + 0.00113\ XGNED + 1230.7\ DXTMS$$
$$(2.9)\quad (26.9)\qquad\qquad (0.9)\qquad\qquad (6.4)$$

$RBAR^2 = 0.97$ $\quad DW = 1.91$ $\quad SEE = 386.1$ $\quad YBAR = 13415.0$

National Income Components

1. Corporate Profits

$$YCRP/YGNPD = - 0.0961 + 0.90104\ (YCRP_{-1}/YGNPD_{-1})$$
$$(2.5)\quad (28.2)$$

$$+ \underset{(5.3)}{0.1583} * \left\{ \frac{XGDP}{[(XGDP_{-1} + XGDP_{-2} + XGDP_{-3} + XGDP_{-4})/4]} \right\}$$

$$- \underset{(2.2)}{0.0558} * (YLI/XGDP)/PGDP) / [[(YLI/XGDP)/PGDP]_{-1})$$

$$+ \underset{(7.4)}{0.00887}\ DYCRP$$

$RBAR^2 = 0.93$ $DW = 1.81$ $SEE = 0.0045$ $YBAR = 0.1055$

2. Other Incomes (Rent, etc.) (AR1)

$$\text{Log}(YBRI/YBRI_{-1}) = \underset{(0.01)}{0.000053} + \underset{(4.9)}{1.1048}\ \text{Log}(YGNPD/YGNPD_{-1})$$

$$+ \underset{(1.6)}{0.0511}\ \text{Log}(RG35_{-1}/RG35_{-2})$$

$RBAR^2 = 0.29$ $DW = 2.0$ $SEE = 0.03$ $YBAR = 0.03$

$RHO = -0.359$

3. Interest, Dividends, and Other Incomes

$$\text{Log}(YBRT/YBRT_{-1}) = \underset{(1.1)}{0.00565} + \underset{(5.9)}{0.47765}\ \text{Log}(YBRI/YBRI_{-1})$$

$$+ \underset{(3.0)}{0.2545}\ \text{Log}(GIPD/GIPD_{-1})$$

$RBAR^2 = 0.34$ $DW = 2.2$ $SEE = 0.024$ $YBAR = 0.029$

Output Sector

1. Output – Goods Sector

$$\text{Log}(XGDG/XGDG_{-1}) = \underset{(2.1)}{-0.0196} + \underset{(9.5)}{0.9145}\ (0.6*LDXGNG + 0.3*LDXGNG_{-1}$$

$$+ 0.1*LDXGNG_{-2}) - \underset{(1.8)}{0.03041}\ \text{Log}(XGDG_{-1}/XGNG_{-1})$$

$$+ \underset{(1.1)}{0.20343}\ \text{Log}(XGNS_{-1}/XGNS_{-2})$$

[$LDXGNG = \text{Log}(XGNG/XGNG_{-1})$]

$RBAR^2 = 0.56$ $DW = 1.5$ $SEE = 0.012$ $YBAR = 0.00574$

2. Output – Commercial Services

$$\text{Log}(XGDSC/XGDSC_{-1}) = \underset{(2.1)}{0.00491} + \underset{(3.5)}{0.58565}*(0.7*LDXGSC + 0.3*LDXGSC_{-1})$$

$$+ \underset{(0.7)}{0.0404}\ \text{Log}\ (XGNG_{-1}/XGNG_{-2})$$

$$+ \underset{(2.0)}{0.15014}*\text{Log}(XGCE_{-1}/XGCE_{-2})$$

{$LDXGSC = \text{Log}[(XGNS - 0.95*XGCE)/(XGNS_{-1} - 0.95*XGCE_{-1})]$}

$RBAR^2 = 0.15$ $DW = 1.5$ $SEE = 0.0092$ $YBAR = 0.01275$

3. Output – Noncommercial Services

$$\text{Log}(XGDSN/XGDSN_{-1}) = \underset{(2.0)}{0.00226} + \underset{(4.8)}{0.5118}*(\ 0.32*LDXGCE + 0.26*LDXGCE_{-1}$$

$$+ 0.21*LDXGCE_{-2} + 0.21*LDXGCE_{-3})$$

$$+ \underset{(1.5)}{0.06482}*\text{Log}[(XGNG_{-1} + XGNS_{-1} - 0.95*XGCE_{-1})/$$

$$(XGNG_{-2} + XGNS_{-2} - 0.95*XGCE_{-2})]$$

[$LDXGCE = \text{Log}(XGCE/XGCE_{-1})$]

$RBAR^2 = 0.26$ $DW = 2.1$ $SEE = 0.0056$ $YBAR = 0.00708$

Labour

1. Total Employment – Goods Sector (AR1)

$$\text{Log}(ECTG) = \underset{(4.0)}{-3.4436} + \underset{(21.4)}{0.5751}\ \text{Log}(XGDG) - \underset{(2.0)}{0.09267}\ \text{Log}(XKG)$$

$$- \underset{(4.8)}{0.15724}\ \text{Log}(WATG/PGDG) - \underset{(1.2)}{0.13027}\ \text{Log}[XGDSC/XGDSC(-1)]$$

$RBAR^2 = 0.93$ $DW = 1.5$ $SEE = 0.01$ $YBAR = 1.17$

$RHO = 0.9386$

2. Total Employment – Commercial Services (AR1)

$$\underset{(24.5)}{-5.5595} + \underset{(6.3)}{0.50757}\ \text{Log}(XGDSC) + \underset{(2.9)}{0.16103}\ \text{Log}(XKSC)$$

$$- \underset{(3.3)}{0.15618}\ \text{Log}(WATSC/PGDSC)$$

$RBAR^2 = 0.97$ $DW = 2.2$ $SEE = 0.007$ $YBAR = 1.44$

$RHO = 0.7946$

3. Total Employment – Noncommercial Services

$$\underset{(18.7)}{-8.4431} + \underset{(3.7)}{0.51832}\ \text{Log}(XGDSN) + \underset{(3.2)}{0.36072}\ \text{Log}(XKSN)$$

$$- \underset{(3.5)}{0.12553}\ \text{Log}(WATSN/PGDSN) + \underset{(5.4)}{0.01424}\ DECTSN$$

$RBAR^2 = 0.89$ $DW = 2.0$ $SEE = 0.006$ $YBAR = 0.71$

$RHO = 0.8689$

4. Average Participation Ratio (LFTC/NPOP)

$$\text{Log}(APRT) = \underset{(2.6)}{-0.17682} + \underset{(13.9)}{0.8389}\ \text{Log}(APRT_{-1}) + \underset{(1.7)}{0.0147}\ \text{Log}(WAT/PCPI)$$

$$+ \underset{(2.2)}{0.000261}\ TIME$$

$RBAR^2 = 0.98$ $DW = 1.95$ $SEE = 0.0046$ $YBAR = -0.512$

Wages and Prices Sector

Wages

1. Average Weekly Wage – Goods Industries

$$\text{Log}(WATG/WATG_{-4}) = \underset{(13.0)}{0.076} - \underset{(15.5)}{0.09872}\ \text{Log}[(UR_{-1} + UR_{-2} + UR_{-3} + UR_{-4})/$$

$$(URN_{-1} + URN_{-2} + URN_{-3} + URN_{-4})]$$

$$+ \underset{(9.5)}{0.97698}\ \text{Log}[(PG_{-1} + PG_{-2} + PG_{-3} + PG_{-4})/$$

$$(PG_{-2} + PG_{-3} + PG_{-4} + PG_{-5})] + 0.0612 \underset{(4.5)}{\text{Log}}(PCPI_{-1}/PCPI_{-5})$$

$$+ 0.0918 \underset{(4.5)}{\text{Log}}(PCPI_{-2}/PCPI_{-6}) + 0.0918 \underset{(4.5)}{\text{Log}}(PCPI_{-3}/PCPI_{-7})$$

$$+ 0.0612 \underset{(4.5)}{\text{Log}}(PCPI_{-4}/PCPI_{-8}) + 0.04181 \underset{(14.4)}{DWATG}$$

$[PG = XGDG/ECTG]$

$RBAR^2 = 0.88$ $DW = 1.77$ $SEE = 0.0132$ $YBAR = 0.0872$

2. Average Weekly Wage – Commercial Services

$$\text{Log}(WATSC/WATSC_{-4}) = 0.061276 - 0.082555 \underset{(13.0)\quad(17.4)}{\text{Log}}[(UR_{-1} + UR_{-2} + UR_{-3} + UR_{-4})/$$

$$(URN_{-1} + URN_{-2} + URN_{-3} + URN_{-4})]$$

$$+ 1.4019 \underset{(5.6)}{\text{Log}}[(PS_{-1} + PS_{-2} + PS_{-3} + PS_{-4})/$$

$$(PS_{-2} + PS_{-3} + PS_{-4} + PS_{-5})]$$

$$+ 0.0774 \underset{(7.6)}{\text{Log}}(PCPI_{-1}/PCPI_{-5})$$

$$+ 0.1161 \underset{(7.6)}{\text{Log}}(PCPI_{-2}/PCPI_{-6})$$

$$+ 0.1161 \underset{(7.6)}{\text{Log}}(PCPI_{-3}/PCPI_{-7})$$

$$+ 0.0774 \underset{(7.6)}{\text{Log}}(PCPI_{-4}/PCPI_{-8}) + 0.03332 \underset{(14.7)}{DWATSC}$$

$[PS = XGDSC/ECTSC]$

$RBAR^2 = 0.92$ $DW = 1.77$ $SEE = 0.0101$ $YBAR = 0.079$

3. Average Weekly Wage – Noncommercial Services

$$\text{Log}(WATSN/WATSN_{-4}) = 0.00864 + 0.7952 \underset{(1.0)\quad(7.8)}{\text{Log}}(WATSC_{-1}/WATSC_{-5})$$

$$+ 0.0433 \underset{(1.6)}{\text{Log}}(PCPI_{-1}/PCPI_{-5})$$

$$+ 0.0636 \underset{(1.6)}{\text{Log}}(PCPI_{-3}/PCPI_{-6}) + 0.0636 \underset{(1.6)}{\text{Log}}(PCPI_{-7}/PCPI_{-7})$$

$$+ 0.0433 \underset{(1.6)}{\text{Log}}(PCPI_{-8}/PCPI_{-8})$$

$RBAR^2 = 0.63$ $DW = 1.6$ $SEE = 0.025$ $YBAR = 0.0868$

Prices

1. GDP Deflator – Goods

$$\text{Log}(PGDG/PGDG_{-1}) = \underset{(1.2)}{0.00926} + \underset{(2.1)}{0.1082}\,\text{Log}(ULCG) + \underset{(2.1)}{0.1623}\,\text{Log}(ULCG_{-1})$$

$$+ \underset{(2.1)}{0.1623}\,\text{Log}(ULCG_{-2}) + \underset{(2.1)}{0.1082}\,\text{Log}(ULCG_{-3})$$

$[ULCG = (YWTG/XGDG)/(YWTG_{-1}/XGDG_{-1})]$

$RBAR^2 = 0.13$ $DW = 2.0$ $SEE = 0.032$ $YBAR = 0.018$

2. GDP Deflator – Commercial Services

$$\text{Log}\,(PGDSC/PGDSC_{-1}) = \underset{(0.6)}{0.002365} + \underset{(3.5)}{0.1638}\,\text{Log}(ULCSC) + \underset{(3.5)}{0.2456}\,\text{Log}(ULCSC_{-1})$$

$$+ \underset{(3.5)}{0.2456}\,\text{Log}(\text{ULCSC}_{-2}) + \underset{(3.5)}{0.1638}\,\text{Log}(\text{ULCSC}_{-3})$$

$[ULCSC = (YWTSC/XGDSC)/(YWTSC_{-1}/XGDSC_{-1})]$

$RBAR^2 = 0.13$ $DW = 2.0$ $SEE = 0.018$ $YBAR = 0.015$

3. GDP Deflator – Noncommercial Services

$$\text{Log}(PGDSN/PGDSN_{-1}) = \underset{(1.3)}{0.00816} + \underset{(2.1)}{0.1229}\,\text{Log}(ULCSN) + \underset{(2.1)}{0.1843}\,\text{Log}(ULCSN_{-1})$$

$$+ \underset{(2.1)}{0.1843}\,\text{Log}(ULCSN_{-2}) + \underset{(2.1)}{0.1229}\,\text{Log}(ULCSN_{-3})$$

$[ULCSN = (YWTSN/XGDSN) / (YWTSN_{-1}/XGDSN_{-1})]$

$RBAR^2 = 0.1$ $DW = 2.1$ $SEE = 0.02$ $YBAR = 0.021$

4. Consumer Expenditure Deflator – Goods

$$\underset{(6.5)}{\text{Log}(PCEG/PCEG_{-1}) = 0.006671} + \underset{(1.2)}{0.0202\ \text{Log}\frac{[YITS/(XCET*PCET)]}{[YITS_{-1}/(XCET*PCET)_{-1}]}}$$

$$+ \underset{(2.9)}{0.11669\ \text{Log}(PIM/PIM_{-1})} + \underset{(2.6)}{0.03414\ \text{Log}(XCEG/XCEGTR)}$$

$$+ \underset{(6.1)}{0.0653\ \text{Log}(PGDG/PGDG_{-1})} + \underset{(6.1)}{0.098\ \text{Log}(PGDG_{-1}/PGDG_{-2})}$$

$$+ \underset{(6.1)}{0.098\ \text{Log}(PGDG_{-2}/PGDG_{-3})} + \underset{(6.1)}{0.0653\ \text{Log}(PGDG_{-3}/PGDG_{-4})}$$

$$+ \underset{(8.1)}{0.01326\ DPCEG}$$

$RBAR^2 = 0.\,.4$ $\quad DW = 2.2$ $\quad SEE = 0.0048$ $\quad YBAR = 0.0153$

5. Consumer Expenditure Deflator – Services

$$\underset{(9.8)}{\text{Log}(PCES/PCES_{-1}) = 0.011155} + \underset{(0.2)}{0.002147\ \text{Log}\frac{[YITS/(XCET*PCET)]}{[YITS_{-1}/(XCET*PCET)_{-1}]}}$$

$$+ \underset{(2.5)}{0.08339\ \text{Log}(PIM/PIM_{-1})} + \underset{(3.0)}{0.070665\ \text{Log}(XCES/XCESTR)}$$

$$+ \underset{(5.3)}{0.0769\ \text{Log}(PGDSC/PGDSC_{-1})}$$

$$+ \underset{(5.3)}{0.1154\ \text{Log}(PGDSC_{-1}/PGDSC_{-2})}$$

$$+ \underset{(5.3)}{0.1154\ \text{Log}(PGDSC_{-2}/PGDSC_{-3})}$$

$$+ \underset{(5.3)}{0.0769\ \text{Log}(PGDSC_{-3}/PGDSC_{-4})} + \underset{(2.8)}{0.006188\ DPCES}$$

$RBAR^2 = 0.50$ $\quad DW = 1.42$ $\quad SEE = 0.0096$ $\quad YBAR = 0.018$

6. Consumer Price Index

$$\underset{(0.8)}{\text{Log}(PCPI/PCPI_{-1}) = 0.0007592} + \underset{(17.9)}{1.00154\ \text{Log}(PCET/PCET_{-1})}$$

$RBAR_2 = 0.80$ $\quad DW = 2.1$ $\quad SEE = 0.0036$ $\quad YBAR = 0.0168$

7. Import Price Deflator

$$\text{Log}(PIM^*/PIM^*) = -0.00532 + 1.1441\ \text{Log}(PGUS/PGUS_{-1})$$
$$(1.8) \quad (6.2)$$

$$+ 0.47867\ \text{Log}(REX/REX_{-1}) + 0.02847\ DPIM$$
$$(5.9) \quad (8.8)$$

$[PIM^* = PIM(1 + RITM)]$

$RBAR^2 = 0.72$ $DW = 1.96$ $SEE = 0.0097$ $YBAR = 0.0144$

8. Price Deflator – Government Current and Capital Expenditures (AR1)

$$\text{Log}(PGT/PGT_{-1}) = 0.005783 + 0.83073\ \text{Log}(PGNP/PGNP_{-1})$$
$$(3.1) \quad (8.2)$$

$RBAR^2 = 0.99$ $DW = 2.8$ $SEE = 0.0136$ $YBAR = -0.435$

$RHO = -0.409$

Monetary Sector

1. Demand for Money (M1)

$$\text{Log}(M1/PGNP) = 0.3698 + 0.9143\ \text{Log}(M1_{-1}/\text{PGNP}_{-1}) + 0.04617\ \text{Log}(XGNED)$$
$$(1.5) \quad (34.3) \quad (3.0)$$

$$- 0.0077\ \text{Log}(RTB) - 0.0116\ \text{Log}(RTB_{-1}) - 0.0116\ \text{Log}(RTB_{-2})$$
$$(5.2) \quad (5.2) \quad (5.2)$$

$$- 0.0077\ \text{Log}(RTB_{-3})$$
$$(5.2)$$

$RBAR^2 = 0.96$ $DW = 1.84$ $SEE = 0.0172$ $YBAR = 10.15$

2. Treasury Bill Rate (AR1)

$$\text{Log}(RTB) = -3.274 + 1.0525\ \text{Log}(XGNED) + 0.59768\ \text{Log}(RTBUS)$$
$$(0.6) \quad (3.9) \quad (7.0)$$

$$- 0.9178\ \text{Log}(M1/PGNP) + 0.8837\ \text{Log}(PGNP/PGNP_{-1})$$
$$(2.0) \quad (2.2)$$

$$+ 1.5464\ \text{Log}(PGNP_{-1}/PGNP_{-2}) + 1.9882\ \text{Log}(PGNP_{-2}/PGNP_{-3})$$
$$(2.2) \quad (2.2)$$

$$+ 2.2091\ \text{Log}(PGNP_{-3}/PGNP_{-4}) + 2.2091\ \text{Log}(PGNP_{-4}/PGNP_{-5})$$
$$(2.2) \quad (2.2)$$

$$+ 1.9882 \underset{(2.2)}{\text{Log}}(PGNP_{-5}/PGNP_{-6}) + 1.5464 \underset{(2.2)}{\text{Log}}(PGNP_{-6}/PGNP_{-7})$$

$$+ 0.8837 \underset{(2.2)}{\text{Log}}(PGNP_{-7}/PGNP_{-8})$$

$RBAR^2 = 0.72$ $DW = 2.0$ $SEE = 0.091$ $YBAR = 0.435$

$RHO = 0.80$

3. 3–5 Year Government Bond Rate (AR1)

$$\underset{(9.2)}{\text{Log}}(RG35) = 0.8053 + \underset{(15.1)}{0.6519}\ \text{Log}(RTB) - \underset{(2.8)}{0.1938}\ \text{Log}(RTB/RTBUS)$$

$$- \underset{(1.9)}{0.39383}\ \text{Log}(GRT/GET)$$

$RBAR^2 = 0.77$ $DW = 1.99$ $SEE = 0.0602$ $YBAR = 0.72$

$RHO = 0.673$

4. Net Private Wealth

$$YNFA3 = \underset{(0.1)}{-234.45414} + \underset{(26.5)}{0.93456}\ YNFA3_{-1} - \underset{(0.74)}{183.5286}\ RTB - \underset{(1.8)}{0.0512}\ GBT$$

$$- \underset{(1.8)}{0.0768}\ GBT_{-1} - \underset{(1.8)}{0.0768}\ GBT_{-2} - \underset{(1.8)}{0.0512}\ GBT_{-3} + \underset{(1.4)}{147.67}\ TIME$$

$RBAR^2 = 0.99$ $DW = 2.4$ $SEE = 3821.7$ $YBAR = 75582.5$

Identities in the Model:

1. Total Personal Consumption

   $XCET = XCEG + XCES$

2. Total Private Investment

   $XITP = XIME + XIRC + XIPV$

3. Gross Domestic Expenditure (real)

   $XGNED = XGNG + XGNS + XRE$

4. Gross National Income (real)

   $XGNE = XGNED + (YNIF/PGNP)$

5. Total Gross Domestic Expenditure – Goods (real)

$$XGNG = XCEG + XITP + (XGCE*0.05) + XGKE + XTXG - XTMS$$

6. Total Domestic Expenditure – Services (real)

$$XGNS = XCES + (XGCE*0.95) + XTXS - XTMS$$

7. Total Wage Bill – Goods Industries (c$)

$$YWTG = ECTG*WATG*52$$

8. Total Wage Bill – Commercial Service Industries (c$)

$$YWTSC = ECTSC*WATSC*52$$

9. Total Wage Bill – Noncommercial Service Industries (c$)

$$YWTSN = ECTSN*WATSN*52$$

10. Total Labour Income (c$)

$$YLI = YWTG + YWTSC + YWTSN + YMPA$$

11. Gross National Income – Domestic (c$)

$$YGNPD = YLI + YCRP + YBRI + YIVA + YITA + YRE$$

12. Gross National Income (c$)

$$YGNP = YGNPD + YNIF$$

13. Total Disposable Income (c$)

$$YDIS = YLI + YBRT + GETRP + TFCNR - TPTG$$

14. Total Personal Savings (c$)

$$YCS = YDIS - (XCET*PCET) - TCNR$$

15. GNE Deflator

$$PGNP = YGNPD/XGNED$$

16. Total GDP (real)

$$XGDP = XGDG + XGDSC + XGDSN$$

17. Total Capital Stock (real)

$$XK = XK(-1) + \left([XITP(-1) - [XGKE(-1)/PGNP(-1)]]/4\right)$$

18. Total Capital Stock – Goods (real)

$$XKG = XK*RXKG$$

19. Total Capital Stock – Noncommercial Services (real)

$$XKSN = XKSN(-1) + \left([XGKE(-1) - [YCCG(-1)/PGNP(-1)]]/4\right)$$

20. Total Capital Stock – Commercial Services (real)

$$XKSC = XK - XKG - XKSN$$

21. Total Employment

$$ECT = ECTG + ECTSC + ECTSN$$

22. Total Labour Force

$$LFTC = APRT*NPOP$$

23. Unemployment Rate

$$UR = [(LFTC - ECT)/LFTC]*100$$

24. Average Wage Rate – For All Economy

$$WAT = [(WATG*ECTG) + (WATSC*ECTSC) + (WATSN*ECTSN)]/ECT$$

25. Total GDP Deflator

$$PGDP = [(XGDG*PGDG) + (XGDSC*PGDSC) + (XDGSN*PGDSN)]/XGDP$$

26. Total Government Revenue (C$)

$$GRT = TDR + TIR + GINV + TRPF$$

27. Total Government Expenditure (c$)

$$GET = [(XGCE + XGKE)*PGT] + GETRP + GETRO + YSUB + GIPD$$

28. Government Balance (c$)

$$GBT = GRT + YCCG - GET$$

29. Total Direct Taxes

$$TDR = RTDR*YGNP$$

30. Total Indirect Taxes

$$TIR = RTIR*(XGDP*PGDP)$$

Figures in parenthesis are *t*-ratios; *AR*1 is the two-stage estimation procedure to correct for serial correlation; c$ – measured in current values; 81$ – measured in constant 1981 prices.

List of Tables and Chart

Tables

1	Structure, Structural Change, and Growth in the Canadian Economy, 1967-86	4
2	Structural and Performance Effects of a $1 Billion Increase in Exports of Goods, 1981 (Q1) to 1986 (Q4)	22
3	Structural and Performance Effects of a $1 Billion Increase in Exports of Services, 1981 (Q1) to 1986 (Q4)	23
4	Price Effects of Sector-Specific Increases in Indirect Taxes by 1 Per Cent	24
5	Structural and Performance Effects of Increased Indirect Tax of 1 Per Cent on Goods-Sector Output	25
6	Structural and Performance Effects of Increased Indirect Tax of 1 Per Cent on Commercial-Service-Sector Output	26
7	Structural and Performance Effects of Increased Direct Taxes by 10 Per Cent from Historical Rates	28
8	Structural and Performance Effects of a 1-Per-Cent Increase in Goods-Sector Labour Productivity from Historical Values, 1974 (Q1) to 1980 (Q4)	30
9	Structural and Performance Effects of a 1-Per-Cent Increase in Commercial-Service-Sector Labour Productivity from Historical Values, 1974 (Q1) to 1980 (Q4)	31
10	Price Effects of Sector-Specific Increases in Labour Productivity, 1974 (Q4) to 1980 (Q4)	33

Chart

1	A Flow Chart of the Model Structure	11

Bibliography

Bailly, A., et al. [1987]. "Services and production: for a reassessment of economic sectors," *Annals of Regional Science* 21, no. 2, pp. 45-59.

Barber, J. [1988]. "Manufacturing and services: some international comparisons." In *The British Economy After Oil: Manufacturing or Services*, ed. T. Barker and P. Dunne. London: Croom Helm.

Barker, T. and Wm. Peterson, eds. [1987]. *The Cambridge Multisectoral Dynamic Model of the British Economy*. New York: Cambridge University Press.

Barras, R. [1986]. "A comparison of embodied technological change in services and manufacturing industry," *Applied Economics* 18:941-58.

Baumol, W. [1967]. "Macroeconomics of unbalanced growth," *American Economic Review* 57:415-26.

Baumol, W., S. Blackman, and E. Wolff [1985]. "Unbalanced growth revisited: Asymptotic stagnancy and new evidence," *American Economic Review* 75, no. 4, pp. 806-17.

Brown, L. E. [1986]. "Taking in each other's laundry: the service economy," *New England Economic Review* (July/Aug.):20-31.

Clark, C. [1940]. *Conditions of Economic Progress*. MacMillan and Co., Limited.

Driver, C. [1988]. "The employment effects of expanding service industries." In *The British Economy After Oil: Manufacturing or Services*, ed. T. Barker and P. Dunne. London: Croom Helm.

Economic Council of Canada, [1990]. *Good Jobs, Bad Jobs: Employment in the Service Economy*, and [1991], *Employment in the Service Economy*. Ottawa: Supply and Services Canada.

Fuchs, V. [1968]. *The Service Economy*. New York: National Bureau of Economic Research.

Gemmell, N. [1982]. "Economic development and structural change: the role of the service sector," *Journal of Development Studies*, pp. 37-66.

Gershuny, J. I. and I. D. Miles [1983]. *The New Service Economy*. London: Frances Pintor.

Grubel, H. G. [1987]. "All traded services are embodied in materials or people," *The World Economy* 10, no. 3, pp. 319-30.

Grubel, H. G. and M. A. Walker (1988]. *Service Industry Growth: Causes and Effects*. Vancouver: The Fraser Institute.

Helliwell, J. F., T. Maxwell, and H.E.L. Waslander [1979]. "Comparing the dynamics of Canadian macro models," *Canadian Journal of Economics* 12:181-94.

Inman, R. P. [1985]. "Introduction and overview." In *Managing the Service Economy: Prospects and Problems*, ed. R. P. Inman. New York: Cambridge University Press, pp. 1-26.

Kravis, I. B., A. W. Heston, and R. Summers [1983]. "The share of services in economic growth." In *Global Econometrics: Essays in Honour of Lawrence R. Klein*, ed. F. G. Adams and B. G. Hickman. Cambridge: The MIT Press.

Leveson, I. [1985]. "Services in the U.S. economy." In *Managing the Service Economy: Prospects and Problems*, ed. R. P. Inman. New York: Cambridge University Press, pp. 89-102.

Magun, S. [1982]. "The rise of service employment in the Canadian economy," *Relations Industrielles* 37, no. 3, pp. 328-55.

Ontario Ministry of Treasury and Economics [1986]. *Background Notes on the Service Sector in Ontario*. Toronto.

Picot, W. G. [1986]. *Canada's Industries: Growth in Jobs over Three Decades*. Ottawa: Statistics Canada.

Ray, G. F. [1986]. "Productivity in services," *National Institute on Economic Review* 115:44-47.

Rowthorn, R. E. and J. R. Wells [1987]. *Deindustralization and Foreign Trade*. New York: Cambridge University Press.

Summers, R. [1985]. "Services in the industrial economy." In *Managing the Service Economy: Prospects and Problems*, ed. R. P. Inman. New York: Cambridge University Press, pp. 89-102.

Van Gemert, H. G. [1987]. "Structural change in OECD countries: a normal pattern analysis," *De Economist* 135, no. 1, pp. 29-51.

Worton, D. A. [1969]. "The service industries in Canada 1946-1966." In *Production and Productivity in the Service Industries*, ed. V. R. Fuchs. NBER, New York: Columbia University Press, pp. 237-86.